INTEGRATED EDITION OF THE PETROLEUM ENGINEER

the Petroleum Engineer

FOR MANAGEMENT

FEBRUARY 1959

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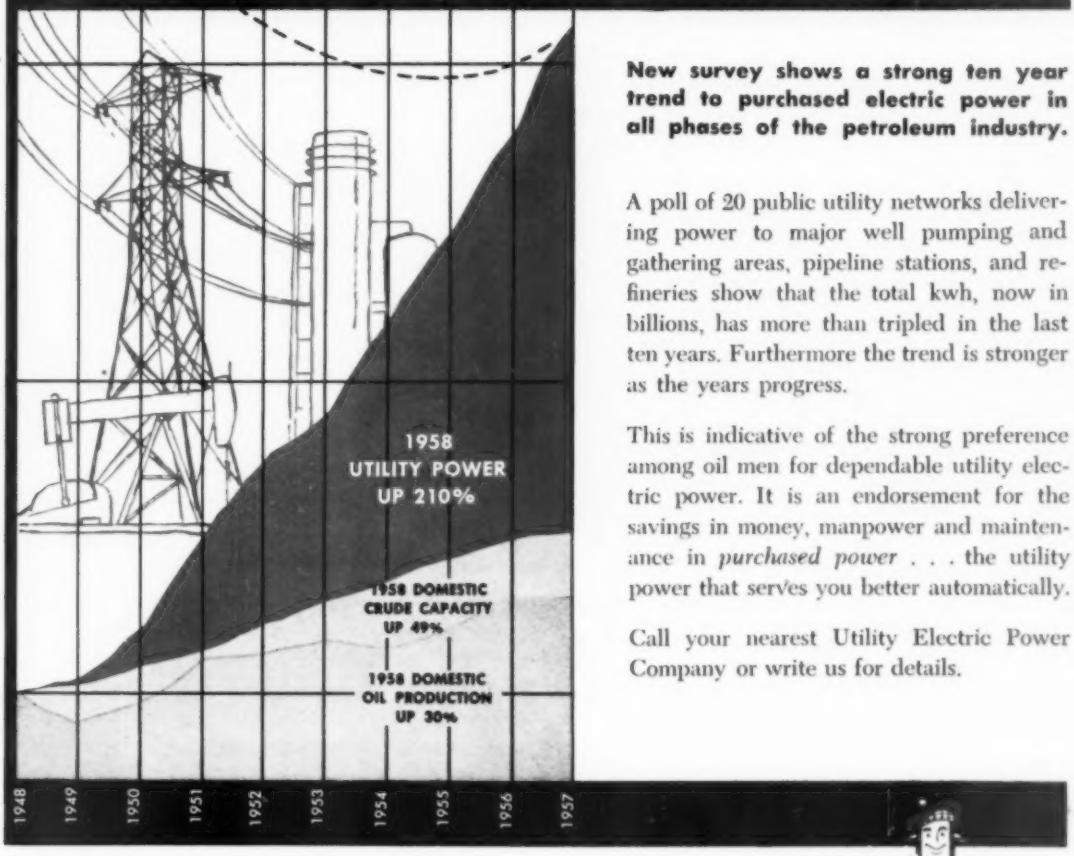

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THE PETROLEUM Engineer

FOR OPERATING MANAGEMENT / an integrated edition of The Petroleum Engineer

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The Petroleum Engineer for Management

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THE PETROLEUM Engineer
FOR MANAGEMENT
INTEGRATED EDITION OF THE PETROLEUM ENGINEER

THE PETROLEUM Engineer
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Don't Break the Chain

PITCH AND NEPHTHAR were in use when history began. What prehistoric caveman first dabbed the evil-smelling black goo on a wound or what nomad dipped a stick in an oil seep for a torch, will never be known.

There is even some argument that Colonel Drake a hundred years ago drilled the first successful oil well.

But who disputes the fact that the U. S. industry led the world in a surge of development that ushered in a new age? A fantastic genii drawn from the earth lifted slavery from men's backs and carried science and industry and transportation to new heights.

The capital it took to go into far-off places came from the eager demand of an expanding United States. British and Dutch enterprisers found fresh capital to plunge into oil exploration in Burma and Sumatra. With money from Burma oil the British financed once-discouraging Middle East projects, which in turn brought in funds to tackle Australia.

The chain of capital and operations spread over the earth and reached unlikely places. It was Shell with money and experience from the Far East that developed the first commercial oil in Venezuela about 45 years ago. Now Venezuela is putting the squeeze on the oil companies which helped develop the country.

You remember the warning in chain letters that bad luck will follow if you break the chain? Only the superstitious believe that. But to break the chain of oil development is bad luck in economic fact.

Venezuela sought and received the capital and experience from other countries to raise the nation to a high standard of living. Would it now hoard its benefits?

Not all the profits from its oil stays in Venezuela, it is true. Some of it goes to people who have risked their money in companies that operate there. But that is small compared to the portion that goes to finance oil development not only in Venezuela but in other countries that are now in the same position Venezuela was in 1914. Will Venezuela, pride of South America, break the flow of money and experience to build reserves for the future?

Venezuela is only the most recent of many nations who for uncertain political gain would bottle up the industry. Others have plans to grab the generated capital so vital to a strong chain of development.

In the U. S. a political move to lower the depletion allowance will have the same effect of drying up the flow of oil. For a time it will mean more taxes and more expensive oil and gas products. But soon the capital and experienced personnel the industry builds will begin to shrink not only in this nation but in the other countries of the world where the industry goes to find resources. There will be no funds to open inaccessible and inhospitable areas, to build roads, towns, schools, hospitals, shops, to string electricity and lay water pipes, to set up native contractors and buy their services, to spread good health and sometimes good will, to give a man a pay check for work well done that makes him feel that all's well on this earth.

Don't break the chain — don't break that flow of oil knowledge and operations backed by the huge capital it must have to survive. We can stumble over surpluses but oil shortages in our free world will send us back to the dark ages.

No one industry bears the tax burden today that is carried like the old-man-of-the-sea by the powerful genii of the depths. Jersey Standard, for instance, in 1957 paid governments in the countries where it operates $2.3 billion. All its 463,000 stockholders received only one-sixth that much.

No other industry could move under the tax weight the oil industry supports. The strain right now is heavier than you think and once break the chain and all the governments in all the world will have a hard time mending it again.

Ernestine Adams

Congrats and $25 to Doug Foster, Atlantic Refining Co., Dallas, Texas

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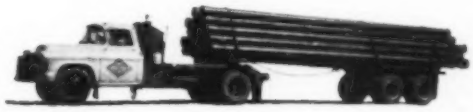

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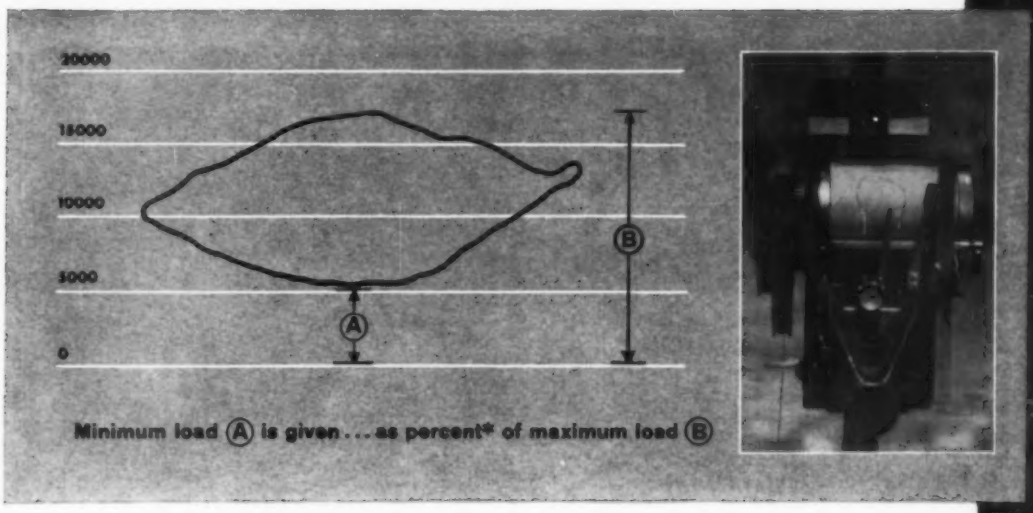
Here is your guide to sucker rod loading!



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GRADE	SIZE											
	⅝"			¾"			⅞"			1"		
*	60%	40%	20%	60%	40%	20%	60%	40%	20%	60%	40%	20%
	NON-CORROSIVE OR EFFECTIVELY INHIBITED											
N	8,596	7,982	6,140	12,376	11,492	8,840	16,828	15,626	12,020	21,980	20,410	15,700
Y	12,280	11,052	10,131	17,680	15,912	14,586	24,040	21,636	19,833	31,400	28,260	25,905
	CARBON DIOXIDE OR SWEET CORROSION											
L	10,745	9,517	8,596	15,470	13,702	12,376	21,035	18,631	16,828	27,475	24,335	21,980
	HYDROGEN SULPHIDE OR SOUR CORROSION											
T	10,745	9,210	7,675	15,470	13,260	11,050	21,035	18,030	15,025	27,475	23,550	19,625

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Petroleum Profile

THE OIL INDUSTRY has been accused of having a lot of braggarts and we'll even admit to a few. But we acknowledge, too, that we have at the same time, the greatest understaters in the business.

Tom Wallace, for instance, will tell you with a straight face he drifted into the oil business because he couldn't compete with those high-powered electrical engineers he graduated with in 1926 at Texas A&M. We don't know how those sharp brains he temporarily associated with came out, but T. H. Wallace, vice president, director, and general manager of Western Gulf Oil Company, has done all right with his genial personality and he has plenty of brainpower, too.

What we mean is, he has been successful in his career; he heads a fine family, and he is an effective and respected participant in his industry and community affairs.

What more do you want? Some excitement, for goodness sake! Well, he has had that, too.

Becomes Electrical Engineer

Tom Wallace grew up in a pretty affluent – if unpretentious — family. His father was superintendent of a lumber company that marketed short leaf yellow pine in deep East Texas — Polk County to be exact. Tom was born in Old Willard and went to Sour Lake High School before he went off to Texas A&M and won the electrical engineering degree. When he got out of the university many oil companies had their own power plants. Gulf Oil Company had two and young Wallace was hired to work in one of these at Hull, Texas. This was October 16, 1926.

He got along so well the company made a petroleum engineer of him in 1929. He was in the Gulf Coast division and was stationed at Houston. He moved up to district engineer, and later to assistant district superintendent. Then he was sent to England as a drilling superintendent for operations in that country.

Drilled Well in England

"Gulf sent a drilling superintendent to England?" he was asked.

"There was a drilling boom in England at that time," Wallace enlightened us (and probably you, too). He was manager of field operations for Gulf Exploration Company, Great Britain, Ltd. and drilled one well in the County of Kent, 30 miles south of London. The hole went below 5000 feet but didn't find a thing but English soil. The drilling rig was then moved to a Scottish moor within 20 miles of the North Sea.

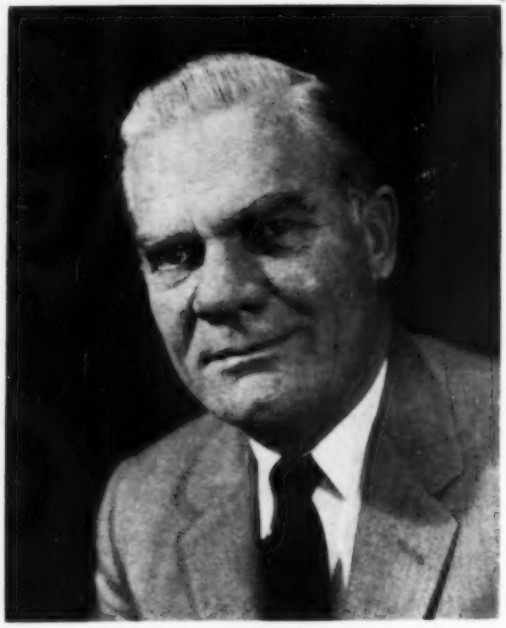
War spread over the earth, encompassing even those optimists drilling on the Scottish moors and Tom Wallace came back to the States in November, 1939.

"With women and children," he says dryly.

He didn't remain in the United States long. He and three drillers went back to England in April 1940 and began operations about the time of the fall of Dunkirk. Gulf called him back to the U.S. again. There was an English field in the Midlands that produced up to 3000 barrels per day during the war, but the company decided big Tom Wallace had better drill down in Southern Louisiana, where it wasn't so hard to locate an oil field. Coming back, he was on the blacked-out S. S. Washington when France capitulated.

Oil for War

In 1941 he was transferred to Western Gulf, a subsidiary operating in California, Oregon, and Washington, as general superintendent, with offices at Bakersfield. His war work was to find oil and lots of it. He did very well at this job, too.



THOMAS H. WALLACE

Vice President-General Manager

Western Gulf Oil Company

He was moved to the Los Angeles office in 1947 and in 1949 was made manager of the production department and executive assistant to R. Paul Huggins, top officer at Los Angeles. In 1952 the tall, energetic Texan-turned-Californian was promoted to the office of vice president when Huggins was moved to Gulf Oil Company headquarters in Pittsburgh.

With three children in school Wallace and his wife, Margret Linn, have spasmodic periods of quiet in their lovely San Fernando Valley home. Thomas Jr. is a graduate in biology from Stanford, has a master's in physiology from the University of Southern California, and is working on his doctorate. William Wallace, the second son, is at Michigan State, working on a petroleum engineering degree. Jean, the youngest and only daughter, is going to Los Angeles Valley Junior College.

When Dick Sneddon wrote a piece about Tom Wallace in the *California Oil World* he stressed his marksmanship. Wallace was a distinguished sharpshooter and now uses his skill for hunting. He likes salt water fishing, too. And if his recreations don't keep him busy outside the office, he can pursue his civic and industry activities. He is a member of American Petroleum Institute, Society of Petroleum Engineers of AIME, Petroleum Club, California Institute of Technology Faculty Club, Oil Club, California Club, etc. He is a director and treasurer of Western Oil & Gas Association, director and vice president of Petroleum Production Pioneers.

Of course your contribution to your industry is not measured by the number of organizations you belong to but by the effort you give. Tom Wallace is generous with time and performance.

Special report to Caterpillar owners:

Parts you can trust. Dependable, round-the-clock service.

PROOF OF THE DIFFERENCE IN THE CAT "HI-ELECTRO" HARDENED CUTTING EDGE

Whether loading scrapers or bulldozing, the cutting edge takes more punishment than any other part of the machine—more punishment today than ever before. New, larger, more powerful machines put greater demands on cutting edges. And the edge that's holding up best and lasting the longest is the Cat "Hi-Electro" hardened cutting edge—the edge with the difference. From all over the country, documented results from on-the-job comparative tests with other makes of edges confirm this fact. The best buy is the Cat edge.

ROUGH JOBS like this put cutting edges to severe tests. And here is where tough Caterpillar edges prove their superiority.

• • •

Field tests prove that the edge with the difference, the Cat cutting edge, not only outwears other make edges of the same thickness; it even outlasts the thicker edges of other manufacturers. The reason: Caterpillar engineers perfected a hardening process to give steel the right blend of toughness and hardness —toughness to prevent breaking, hardness to prevent bending and rapid wear.

• • •

Quality edges start with quality steel, tested in Caterpillar's laboratories for the right chemical composition and physical characteristics. Only steels meeting these exact specifications are accepted, and further tests are made at every stage of production.

CROSS SECTION of edge showing armor-like case and its shock-absorbing core.

NOW AVAILABLE—NEW MULTI-SECTION 'DOZER EDGES

New multi-section 'dozer edges developed by Caterpillar for the D8 and D9 show the way to reduced blade costs and easier blade changing. Reduced blade costs can result from piece-by-piece replacement. You can now reverse and replace the worn sections. Changing is easier than ever before.

• • •

Service tip: When installing new or reversing "Hi-Electro" hardened edges, clean all dirt from the matching surfaces. Be sure that all bolt heads are properly drawn in to their holes and correct nut torque applied. This assures proper cutting edge support and maximum strength.

• • •

Your Caterpillar dealer has the complete story on the advantages of using the new Cat multi-section 'dozer edges. He backs you with dependable, round-the-clock service and parts you can trust. See him today!

NEW EDGES are now available for the D8 Bulldozer in left and right sections shown here. New edges for the D9 come in left, center and right sections.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR

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THIS IS YOUR CAREER!

Have you weighed it?
Analyzed its potential?
Made decisions about it?
Set up long-range plans? . . . *Or do you keep your eyes on technical and operational problems and let your career wander through an unrewarding maze?*

YOU go over an operational, technical or organizational problem thoroughly, obtaining every fact that bears on the case. After much work and study, and often worry, you reach a decision. Then you make every effort to execute it successfully.

How much study do you give the problem of your own business life? Oh, if a new job opens up, you may spend a few days deciding whether to take it. But you don't really research your own personal career. Why not?

Usually, it's because you have only a dim, uncertain goal in mind and you don't know the path that leads in that direction.

You can't manage a company until you learn directions for steering yourself. You wouldn't think of coming to a decision on a technological problem with the meager facts you usually have when you make a decision for yourself that may completely change your own life.

HOW do you get some system into your career so you have the facts to work with? That is the chief purpose of our new series—"How to be a Manager." It is designed to help you:

1. *Define your goal.*
2. *Organize your business life.*
3. *Prepare to improve your career.*
4. *Learn to evaluate your own progress.*

Put the plans in this series into action and you'll get a sense of purpose and direction — of guiding your destiny instead of being buffeted by events.

The great scientist, Charles F. Kettering, said "Any problem thoroughly understood is fairly simple." This problem you're tackling every day is your career. You can clean out the non-essentials and shape it simply and directly to gain the goal you set.

The entire world is crying for good managers. A. M. Lederer, Chairman of the Board of Council for International Progress in Management, says only competent management can consolidate our vast investment in foreign aid for long range development. In the Free World "the shortage of technicians is acute," he says, "the shortage of trained managers is worse than acute."

IT IS fortunate for the United States that we learned early (though not early enough) there is rising demand for managers and they don't just grow. In the last 10 years management development programs have sprung up all over the land.

"How to be a Manager" is a personal guide for your use. The theme of the series explains it well: "You can't develop executives — you can only help executives develop themselves." This series puts together the successful methods that have been used by men to gain greater opportunities in their careers. You can adapt them to your own.

On the opposite page are titles of the 40 chapters. They will be written by executives, management consultants, and directors of management development courses in colleges and universities. They will be direct, how-to-do-it articles by experts.

Remember . . . the kit you're putting together is your own career. Only you can make it work and check its operation. Give it thorough research and the best methods you can develop. We've sought to supply you with tested and reliable directions in . . .

"How to be a Manager"

Beginning next month in The Petroleum Engineer

How to be a Manager

You can't develop executives — you can only help executives develop themselves.

OUTLINE FOR CAREER PLANNING: 40 SIGNIFICANT OBJECTIVES

HAVE A GOAL

1. Do you want to be a manager?
2. Do you have what it takes to be a manager?
3. Do you know the functions of management?
4. Where do you want to be in 1 year? 5 years? 10 years? 15 years?
5. Do you want to work to gain management objectives?
6. Do you have a philosophy for your working life?

KNOW WHAT IT TAKES TO GET THERE

7. Vision to understand and courage to act.
8. Human relations.
9. Why do people act that way?
10. Basic guides to influencing others.
11. Think about those below you, too.
12. Delegation affects you and others.
13. Understand job just ahead.
14. Don't overlook lateral changes for enlarging your experience.
15. Could your present job be improved in status?
16. Identify your shortcomings for the next step.

PREPARE FOR PROMOTION

17. Read and remember.
18. Take correspondence or night courses.
19. Do on-the-job training.
20. Work on general education as base.
21. Take management courses.
22. Consider sabbatical year for degree.
23. Learn to write effectively.
24. Make speeches.
25. Do community work.
26. Evaluate political views.
27. Gain and keep your family's support.
28. Care for your health.
29. Make leisure count.
30. Teach someone to do your job.
31. Make time to prepare for the bigger job you want.
32. Watch your finances.
33. Learn to choose wisely in business vs personal interest.
34. Keep yourself sold on what you are doing and keep your boss sold on you.

REVIEW AND REVISE (AUDIT)

35. Use check lists periodically to evaluate your development.
36. Study your job. Does it contribute to your career?
37. Are you in a job position box with no way out?
38. Are you compatible with your work?
39. Could man below you fill your spot if you get a promotion?
40. Plans of your days and your years change with circumstances. Keep them flexible without being intangible. Go over your daily schedule, your monthly program, your five-year plan. Keep them up to date. Put each plan in line with your goal and keep your goal in clear view.

For your own file of this career guide series, "How to be a Manager," enter your personal subscription today. The first installment begins next month.

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HIGHLIGHTS

★ ★ ★

Digest of News and Comments

B of M Estimates for 1959

U. S. Bureau of Mines estimates for 1959 include:

Total demand rise of 4 percent to 9,647,000 bbl per day.

Domestic demand up 4.3 percent to 9,378,000 bbl per day.

Crude oil production up 8.6 percent to an average of 7,280,000 bbl per day. Crude imports to approximate 950,000 bbl per day and products imports will drop to 608,000 bbl per day.

Refinery runs up 6.8 percent to 8,136,000 bbl per day.

This forecast assumes normal weather, no big change in stocks and continuing rise in business activity.

Conservation Members Named

A. E. Chester, vice president of Magnolia Petroleum Company and chairman of the Louisiana-Mississippi-Arkansas-Alabama subcommittee of the Oil Industry Conservation Forum, has named a 10-man group to study conservation regulations in their states. They are W. M. Vaughey of Vaughey and Vaughey, Ed L. Brunini, and I. P. Larue Jr., of Larco Oil Company — all of Jackson, Mississippi — and A. H. Weyland of Arkansas Fuel Oil Corporation and Carlton Lyons Sr., of Lyons and Logan, both of Shreveport. Also named by Chester were Bouwe Dykstra of Shell Oil, W. P. Hardeman of Pan American Petroleum and Earl G. Bateman of Bateman Drilling, all from New Orleans; John E. Howell of Lion Oil, Houston; and Paxton Howard of Shell Oil, Tulsa.

Also recently named by Conservation Forum Chairman E. B. Miller Jr., Tidewater, were several subcommittee chairmen. These include James E. Low of Amerada, to head the New Mexico-Arizona group; Herbert Hunt of Hunt Oil, Dallas, chairman of the Rocky Mountain group; L. E. Fitzjarrald of Phillips Petroleum, to lead the Oklahoma-Kansas group, and Harold Decker of Highland Oil, directing the Texas subcommittee. Vice chairman of the Forum is Jerry O'Brien, immediate past president of TIPRO.

Firms Balk at Venezuelan Tax

Venezuela's decision to hike its income tax, which in effect changes the oil company-government tax split from about 50-50 to about 40-60, has been solidified, despite protests of companies operating in that country. H. W. Haight, president of Creole Petroleum, voiced the industry's dissatisfaction and called the action "a hard blow at oil industry of Venezuela . . . completely disregarding acquired rights and ignoring the moral if not legal obligation to negotiate this rupture with interested parties." Venezuelan ambassador to the U. S., Falcon Briceno, in turn described Haight's statements "offensive to the national dignity . . . and deliberately misleading." The ambassador pointed out that the income tax increases affected every individual, every corporation and every enterprise in Venezuela regardless of domestic or foreign origin.

Colorado O&G Diversifies

Colorado Oil and Gas Corporation has acquired Jas. P. Marsh Corporation of Skokie, Illinois, one of the nation's three largest manufacturers of pressure gages for liquids and gases. All capital shares of the Marsh corporation, founded in 1865, were purchased December 1, 1958 for $4,500,000. Marsh sales in the year ended November 30, 1958, grossed $7,000,000, and reported to be in excellent financial condition with no debt and $1,700,000 in working capital. Officials said an important consideration was the acquisition of Marsh's substantial pre-tax earnings that may be utilized in the expanding exploration and drilling operations of Colorado Oil and Gas, a young company founded in 1954. The company has scheduled an accelerated exploration and drilling program next year in Canada, Alaska and other high potential areas where it holds oil and gas rights on nearly 1,500,000 acres. Colorado Oil and Gas also has extensive drilling, exploration, refining and marketing operations in the Gulf Coast, Mid-Continent and Rocky Mountain areas.

Seaton Names Petroleum Council

Secretary of the Interior Fred Seaton extended the appointment of 102 leaders in the oil and gas industry to the National Petroleum Council for 1959. The 1958 Council never met; a preliminary planning meeting was called December 29, but immediately cancelled because of airline strikes. Activities of the council were stymied last year by federal insistance of several issues suggested by the Justice Department. The new council, under Chairman Walter S. Hallanan met January 27 to discuss proposed changes to by-laws, one demand is appointment of full-time salaried officials of the Interior Department as co-chairman of the council and its committees.

New Imports Policy Decision

Because of failure to agree on all terms of a revised Voluntary Crude Imports Program, the special congressional committee to investigate crude oil imports must again make a choice. The group asked the President and obtained permission to extend the allocations under the old voluntary plan until February 28. The new plan is expected to be a mandatory quota system, combining parts of the original plan giving most quotas to existing importers and part of the plan based on a refinery capacity basis.

Misplaced Quote Marks

J. L. Burke, president of Service Pipe Line Company, misplaced a quotation mark in his "outlook" report published in the January issue of *Pipeline Engineer* (Page D-20) and has asked us to set the record straight. He says:

In my letter on "the outlook for the pipeline industry in 1959," there is an error in the quotation of former Interstate Commerce Commissioner Owen Clarke, resulting from a misplaced quotation mark in the copy we sent you.

Chairman Clarke's quotation should be as follows:

"None of the independent shippers or anyone else has complained to us that the (pipeline) rates were too high. However, frequently in rate cases involving the railroads or the water carriers and the trucks, we hear the complaint that the pipeline rates are too low."

The remainder of the statement is mine rather than Chairman Clarke's:

The non-owner shippers are satisfied with the pipeline rates. They are quite willing to let the shipper-owners take all the burden of ownership while they invest their own capital to better advantage elsewhere.

Good Wells Make Good News

A Monthly Report on Wells That Are Now Worth More

FEBRUARY, 1959

Acidizing is frequently an efficient way to stimulate production from low solubility sands. Here are four recent treatments of this type by Dowell:

- **Carbon County, Wyoming** (New Oil Well) Perforations into Tensleep sandstone were from 6900 to 7000 feet. This formation exhibited about 30 per cent Mud Acid solubility. Initial production was 492 bopd through ¼-inch choke, so fracturing was not necessary. However, operator wanted to clean up bore hole, so Dowell injected a 500-gallon spearhead of Mud Acid. Then 1500 gallons of acid with surface tension reducing, demulsifying and silicate control agents completed the treatment. After clean-up, production stabilized at 1100 bopd through ¼-inch choke. The $1366.00 treatment was paid out in less than two days.

- **Avoyelles Parish, Louisiana** (Old Oil Well) This well was originally completed in the Sparta sand. Production had gradually declined to 30 bopd even though the well had been acidized several times. Dowell recommended Mud Acid to dissolve and disperse any silt that might be plugging perforations. When the well could not be loaded with oil, 25 ball sealers were dropped into the tubing to seal off the thief zone. Then 500 gallons of Mud Acid was pumped into the well, followed by 38 more ball sealers and another 500 gallons Mud Acid. Pressure increases after each injection of balls indicated that additional perforations were being reached. After treatment, production stabilized at 55 bopd. The entire treatment cost of $828.00 was paid out in eight days.

- **Hughes County, Oklahoma** (Old Oil Well) Original completion in 1924 was by nitro-shooting in the open hole. Pay is the tightly-cemented calcareous sand of the Union Valley Cromwell formation which usually responds well to acid. Dowell treated the well with two 3000-gallon stages of regular acid. A temporary plugging agent was injected between the two stages to plug off the most permeable zone. After clean-up, production stabilized at 40 bopd.

- **Hidalgo County, South Texas** (New Gas Well) This well was completed through perforations in the shaly Frio sand. Operator suspected that mud damage to formation was limiting flowing pressure. Dowell recommended acidizing with 1000 gallons super Mud Acid. After treatment, well head pressure rose from 500 to 1500 psi through ¼-inch choke. A planned fracturing treatment was considered unnecessary in view of the excellent results obtained with Mud Acid.

Dowell has the experience, the men and the chemicals needed to acidize your well successfully. For prompt service, call any of the 165 Dowell service points. In Canada, call Dowell of Canada, Ltd.; in Venezuela, United Oilwell Service. Dowell, Tulsa 1, Oklahoma.

Services for the oil industry DOWELL
DIVISION OF THE DOW CHEMICAL COMPANY

Socony Mobil Changes Setup

Basic organizational changes in Socony Mobil Oil Company have been announced. Effective March 1, the company's corporate management will undergo several reassignments, and two new operating divisions are to be created. Mobil Oil Company is to be the new operating division for the U. S. and Canada; Mobil International Oil Company will be the operating group for other countries where Socony Mobil is active. Herbert Willetts, now a member of Socony Mobil's board of directors, will be president of Mobil Oil; Herman J. Schmidt, also a director, will be president of Mobil International. Both Willetts and Schmidt will become executive vice presidents of Socony Mobil.

The corporate organization of Socony Mobil is to be divided into five groups: Administrative, under the direction of Fred W. Bartlett, chairman of the board of directors; research and engineering, under Arthur V. Danner; planning, under Paul V. Keyser, Jr.; exploration and producing, under Fred W. Wilcox; and supply and distribution, and marine transportation, under Clark S. Teitsworth. The latter four have been designated as senior vice presidents of Socony Mobil.

Creole Expands at Amuay

A $7,300,000 expansion and modernization program is underway at Creole Petroleum Corporation's terminal facilities at Amuay in Venezuela. As part of this program, a 1107 ft pier with a loading capacity of 40,000 bbl per hour was completed last March. This pier can handle two supertankers up to 60,000 DWT, and is equipped with new hydraulically-operated, loading lines. Amuay's three smaller piers are being extended by 200 ft each to a length of 870 ft. This project is nearing completion. A third phase of the modernization program already completed is the dredging of the harbor to 41 ft to accommodate the larger tankers.

Ambassador to Explore in Ireland

Ambassador Oil Corporation has been granted concession to explore for oil in Ireland. This is the first time the Irish government has issued an oil or gas lease. Ambassador will drill the first oil or gas exploration well ever drilled in Ireland. The contract granting the concession involves all of Ireland, excluding the six northernmost counties still under British control.

Oil Shale for Red China

Communist China estimates its oil shale resources at 200 billion tons — "enough to provide 60-80 million tons of oil annually for the next 150 years." Deposits reportedly are widely distributed in 21 of China's provinces and autonomous regions.

Petroleum Corrosion at NACE

Corrosion problems in the production, refining and transporting of oil and its products will be discussed in five sessions during the National Association of Corrosion Engineers' 15th Annual Conference and 1959 Corrosion Show, March 16-20, Chicago. Symposia will be held on pipeline corrosion, refinery industry corrosion and oil and gas production corrosion. Other corrosion subjects will be covered in symposia on protective coatings, cathodic protection, marine corrosion, inhibitors and the chemical industry.

President Asks Gasoline Tax

President Eisenhower, in his recent annual budget message, urged an increase in the federal gasoline tax. Although not specific, the administration is expected to ask for a 1½-cent per gallon increase, putting the total federal tax at 4½ cents. The tax increase, designed to carry the federal highway program, is opposed by representatives of the oil industry and user groups. If all present returns from 3-cent tax went to highway program, funds would be ample.

Unions Get Wage Boost

Product price increases are expected to follow wage rises for oil unions of 5 percent, or about 13½ cents an hour. This will bring average pay to $2.90 an hour. No overall increase was granted in the recession year of 1958, but a 6 percent pay boost came in 1957. Offer was made to OCAW an independent unions by Sinclair, Continental, and Gulf and is expected to spread.

Sun to Appeal FTC Decision

Sun Oil Company announced it would appeal decision of Federal Trade Commission that the company violated the anti-trust laws in giving price assistance to one of its Jacksonville, Florida, dealers in 1955. Sun was charged with violating the Clayton and FTC Acts forbidding discriminatory prices. Sun contended that in lowering its price to the dealer it was "meeting competition in good faith" as permitted by law. Sun granted a price reduction to the dealer who appealed for help after a service station across the street posted prices for gasoline as much as seven cents a gallon lower than his price.

Oil Companies Protest

Not only are organizations opposing hikes in federal and state gasoline taxes, individual companies are protesting in specific instances. Several letters to President Eisenhower and to state governors have been written by company officials and reprints circulated. This greater interest outside organization offers hope of stemming product tax tide.

Meetings

Feb. 15-19—AIME, annual meeting, Sir Francis Drake Hotel, San Francisco, Calif.

Feb. 26—ASTM, annual meeting of the Southwest district, Ben Milam Hotel, Houston, Tex.

Feb. 27—NGAA, Permian Basin regional, Scharbauer Hotel, Midland, Tex.

Mar. 1-5—ASME, gas turbine power conference & exhibit, Netherlands-Hilton Hotel, Cincinnati, O.

Mar. 2-11—Midwest Gas Association, annual meeting and convention, Hotel Ft. Des Moines, Des Moines, Iowa.

Mar. 3—PESA, Pacific district, Ambassador Hotel, Los Angeles, Calif.

Mar. 4-6—API, southwestern district meeting, Scharbauer Hotel, Midland, Tex.

Mar. 6—NGAA, Gulf Coast regional meeting, Robert Driscoll Hotel, Corpus Christi, Tex.

Mar. 11—PESA, Southwestern district, Shamrock-Hilton Hotel, Houston, Tex.

Mar. 16-18—WPRA, 47th annual meeting, Hilton Hotel, San Antonio, Tex.

Mar. 16-19—AAPG-SEPM, 44th annual meeting, Memorial Auditorium, Dallas, Tex.

Mar. 16-20—AIChE, Chalfonte Haddon Hall, Atlantic City, N. J.

Mar. 16-20—NACE, 15th annual conference and exhibition, Sherman Hotel, Chicago, Ill.

Mar. 17-19—NACE, 1959 Corrosion Show, Sherman Hotel, Chicago, Ill.

Mar. 18—PESA, Eastern district, Duquesne Club, Pittsburgh, Pa.

Mar. 25-27—API Division of Production, southern district meeting, Roosevelt Hotel, New Orleans, La.

Mar. 31—AIChE, Philadelphia-Wilmington Section, Experience In Industry Symposium, University of Pennsylvania Campus, Philadelphia, Pa.

Mar. 31-Apr. 1-2—Illinois Institute of Technology, 21st American power conference, Hotel Sherman, Chicago, Ill.

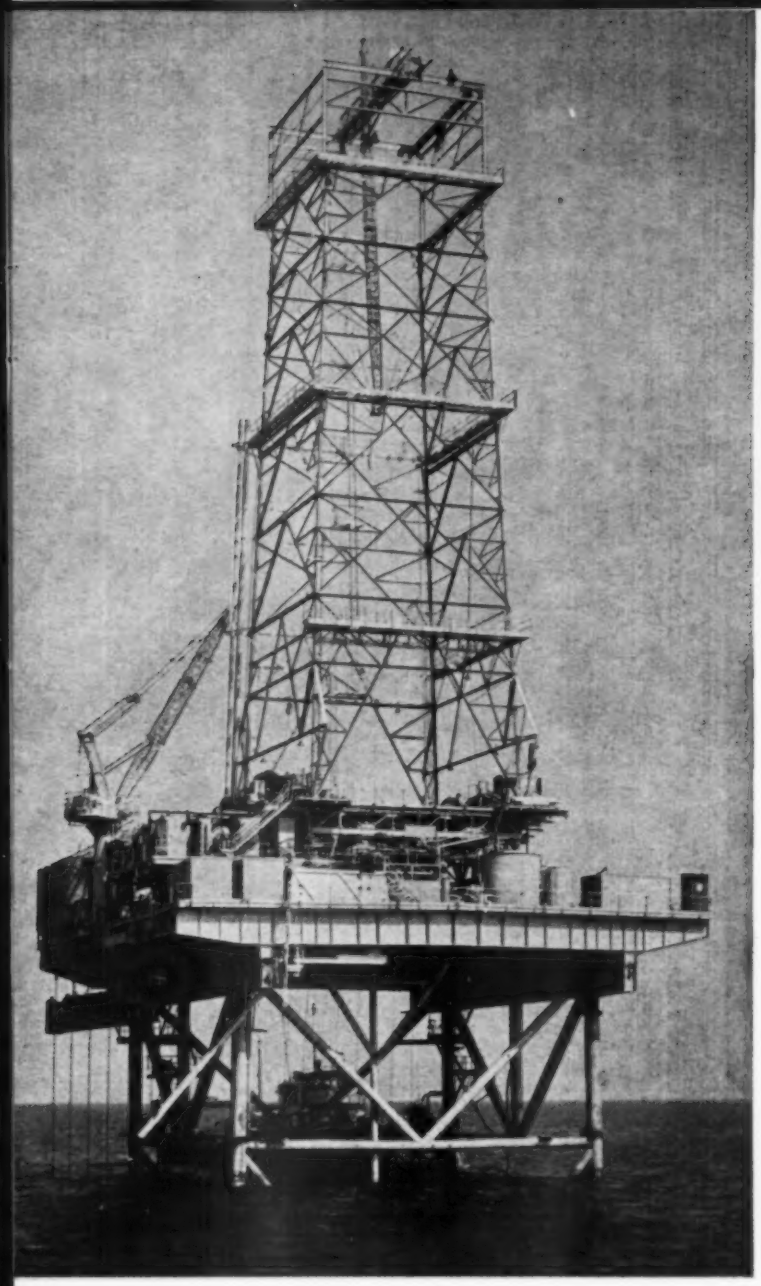
Apr. 2-3—Society of Petroleum Engineers of AIME, Rocky Mountain petroleum section, 5th annual joint meeting, Casper, Wyo.

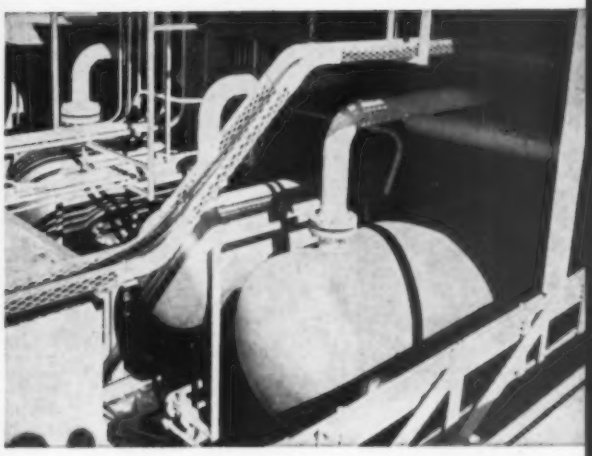
Apr. 5-9—The 1959 Nuclear Congress, Cleveland Auditorium, Cleveland, O.

Apr. 5-10—American Chemical Society, 135th national meeting, Boston, Mass.

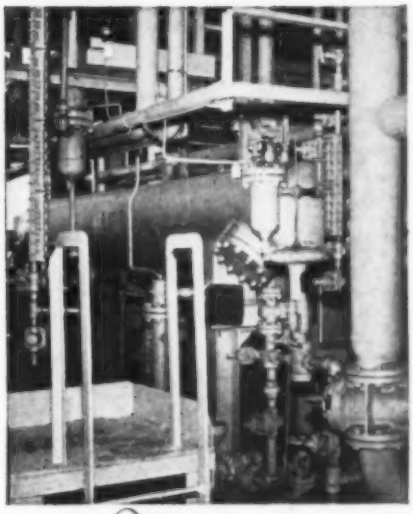
Apr. 6-7—Instrument Society of America, 2nd National Symposium on Chemical & Petroleum Instrumentation, St. Louis, Mo.

Apr. 7-9—Petroleum Industry Electrical Association, annual meeting, Galveston, Tex.





BS&B EQUIPMENT GOES TO SEA



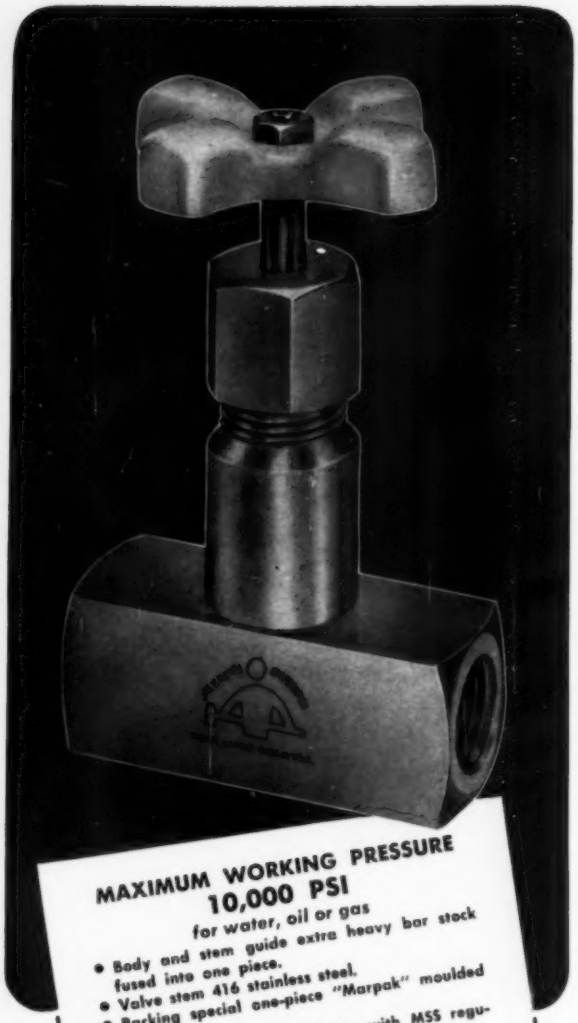
In 100-ft. deep water two miles offshore from Summerland stands California's first permanent-type drilling platform. Equipped with twin crown blocks, this 1,000-ton structure is capable of drilling two wells simultaneously, and will drill up to a total of 25 wells from its present location.

On an installation of this kind, space is at a premium. Aboard the platform the BS&B horizontal production separators with BS&B controls were specially designed to provide compactness, minimum maintenance, and heavy-duty service.

BS&B

ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

BLACK, SIVALLS & BRYSON, INC., DEPT. I-C2 P. O. BOX 1714, OKLAHOMA CITY



MAXIMUM WORKING PRESSURE
10,000 PSI
for water, oil or gas

- Body and stem guide extra heavy bar stock fused into one piece.
- Valve stem 416 stainless steel.
- Packing special one-piece "Marpak" moulded ring.
- Bodies marked in accordance with MSS regulations.

Marsh Needle Valves for Special Applications

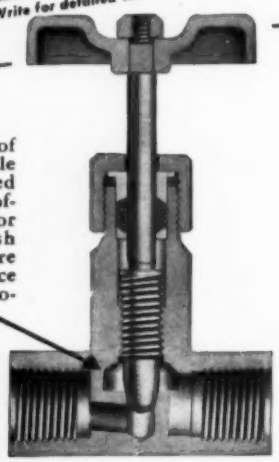
For high pressure air service, Series R1900, hardened stem, Marpak packing system.

For oxygen and helium service, Series R1924, chemically pure, and with Marpak-Teflon packing system.

Write for detailed information

ONE PIECE

The stem guides of conventional needle valves are screwed into bodies—this often causes leakage or blow-outs. Marsh Needle Valves are fused into one-piece by exclusive "Conoweld" process.



The Ultimate in Needle Valves

Here is one of the crowning achievements of Marsh research, design, and manufacturing skill. It is the first needle throttling and shutoff valve to combine *all* of the qualities called for today in this highly critical and ever broadening field.

It is a valve that has strength and safety to spare . . . rated for pressures up to 10,000 psi—equally efficient in the lower ranges. A product of Marsh instrument-making and valve manufacturing experience, it combines instrument-like precision with the ruggedness that distinguishes all Marsh valve specialties.

The illustrations tell the story of new thinking; new standards. Body and stem-guide are machined from extra-heavy carbon steel bar stock. Still greater strength and rigidity are achieved by fusing the stem-guide into the body. The complete fusion of guide and body is accomplished by the exclusive Marsh "Conoweld" process.

There are two big advantages to this one-piece construction: (1) It eliminates the danger of unscrewing the valve from the body when opening—a frequent cause of leakage, even dangerous blow-outs (2) It permits perfect line-up of threads and seat. As a result, Marsh valves are easier to operate even at high pressures.

The precision-machined stem is 416 stainless steel. Stem threads are fine pitch for extra strength and fine, controlled regulation. Notable advancements are special "Marpak" one-piece, non-binding longer-lasting packing; deep thread chambers, keeping inlet and outlet piping away from ports and contributing excellent flow characteristics. Entire packing nut and packing gland are electro-zinc plated, preventing corrosion and giving the valve a handsome, plated exterior. The rugged malleable handle is finished in heavy baked enamel.

The new needle valve line includes globe and angle patterns with double female connections in sizes ⅛", ¼", ⅜", ½", ¾" and 1". Also globe and angle valves with male inlet and female outlet in sizes ¼" and ½". *Complete stock carried at our Skokie, Illinois factory and also at our branch plant in Houston, Texas.*

Write today for catalog giving complete details.

MARSH INSTRUMENT CO. *Sales Affiliate of Jas. P. Marsh Corporation*
Dept. M, Skokie, Ill. • Marsh Instrument & Valve Co. (Canada) Ltd., 8407 103rd St., Edmonton, Alberta • Houston Branch Plant: 1121 Rothwell St., Sect. 15, Houston, Texas

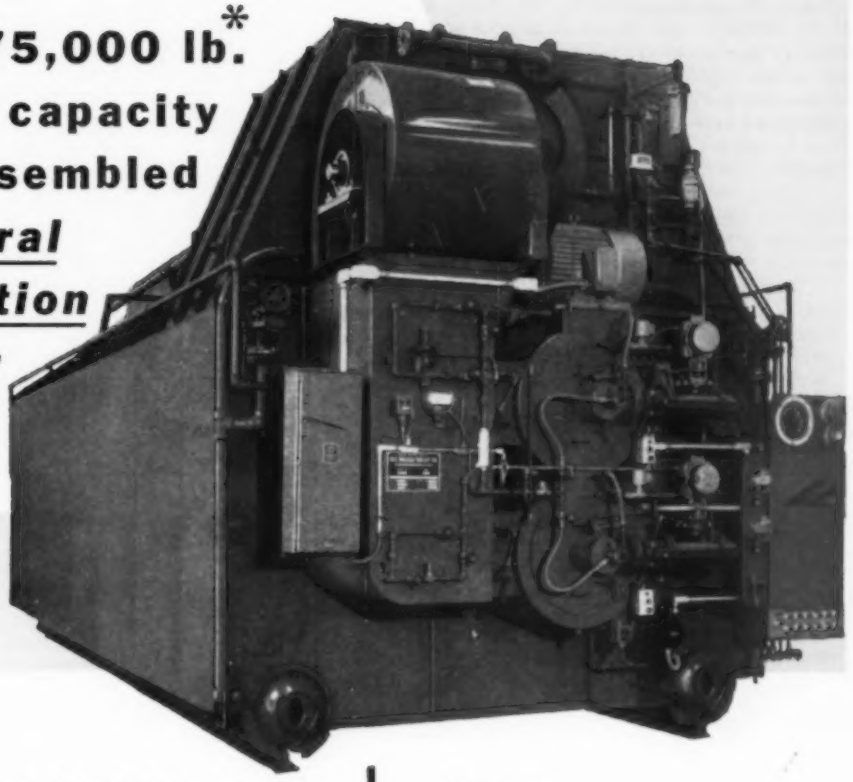
MARSH

"THE STANDARD OF ACCURACY"

FOR FURTHER INFORMATION ON ADVERTISED PRODUCTS, SEE READER SERVICE CARD

...now from WICKES

a new 75,000 lb.* per hour capacity shop-assembled *natural circulation* boiler



*75,000 lbs. per hour present capacity.

80,000 lbs. per hour future capacity with economizer

Wickes Type A units are of simple design, ruggedly constructed and adaptable to a variety of operating conditions and may be Oil or Gas Fired.

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THE CONFERENCE TABLE

We are moving forward at twice the speed of sound and half the speed of sense...
—THOMAS GRIFFITH

Appealing to Capitalistic Instincts

The USSR is not above using man's desire for profit to advance its petroleum industry. The Main Administration of the Scientific and Technical Society of the Petroleum Industry announced three all-union contests. For the first two prizes — 5000 rubles each were given (in legal exchange this is about $1200). The two second prizes were 2500 rubles each, and three third prizes, 1500 rubles each. Four incentive awards of 500 rubles each were also given. Contests in all the three divisions called for:

1. New schemes for the gathering and transportation of crude and gas at oilfields which will eliminate loss of gas and light fractions in the gathering and transportation process.

2. New effective suggestions on improvements in automation, centralized regulations, and remote control of operations and plants at gas fields and gas pipelines, including overall automation.

3. New systems for oilfield exploitation, technological and technical systems for oil production, methods for studying wells, and gaging and designing equipment and control instruments for petroleum production.

Our suggestion to contestants is to translate articles from *The Petroleum Engineer*.

★ *Although this may seem a paradox, all exact science is dominated by the idea of approximation. When a man tells you that he knows the exact truth about anything, you are safe in inferring that he is an inexact man.* —Bertrand Russell

Red and Green Kerosine

Bernard Majewski

Barney Majewski is always doing something unusual. Last fall he came down to Houston, Texas, and told a large civic group there why they must fight for the depletion allowance. He explained why everybody has a stake in preserving the deduction—not just the producers, but refiners, marketers and transporters, jobbers, and service station operators. The thing of it is, so many independent jobbers do not realize this and that's what Barney is—an independent dealer, president of Signal Perfect Fuels, Inc. and Great American Oil Company of Chicago.

One of our favorite sayings is the petroleum industry is lucky because of the men it attracts. Bernard L. Majewski was attracted to it 50 years ago. He began as a kerosine peddler in the young community of Chicago. He still has wonder in his voice as he tells about those early exciting days:

"I was ambitious, enthusiastic and full of hope for the future. I was determined to succeed. And, believe me, I had competition. With a small capacity tank wagon drawn by a well-bred mule team (owned by my mother) I had for my competition the largest oil company in the world—the Standard Oil Company of John D. Rockefeller.

"It would have been very easy then to tell myself that I might as well quit, that I didn't have a chance, that the little man could never survive against the might of that giant competitor. But I guess in my youth there just weren't enough demagogues around to plant that defeatist philosophy in a young man's mind. In any case, it never occurred to me that I was licked, and never having been told that I couldn't compete, I went ahead and competed, and I made things a lot tougher for the Standard Oil Company than they were able to make it for me.

"You see, I had an idea. I had an advantage that they didn't have. I was close to my customers, and I learned something about them—what kind of people they were, what their likes and dislikes would be, what I could do to please them and win their loyalty.

"My route was in the tenement district of Chicago and many of my customers were of Irish or Polish origin. So I took to coloring my kerosine. I dyed it red for the Poles, and green for the Irish. And how they went for that colored kerosine. They doted on this beautification of an every day product. They were willing to pay a premium price to buy from Mary Majewski's oldest boy, Barney.

"And I can't say I blamed them for that. For even today I can still see in my mind's eye what a beautiful sight that red or green kerosine made in the bowl of a lighted lamp.

"Well, it wasn't long after I got into the oil business, that manufactured gas and electric lighting came along on a big scale, and the kerosine trade began to wane. But along came a bigger and greater opportunity—the gasoline buggy, and it seemed to me that the future was brighter than ever. Not with the glow of red kerosine in an oil lamp, but with the rumble of automobiles—the grand old Model T—opening up new adventure, new experiences, new horizons for Americans of all income groups.

"This was a revolution. This was a new kind of democracy — where an ordinary working man and his family could enjoy travel convenience and speed beyond the dreams of kings just one generation back. This is the kind of revolution we have in America—a revolution that opened the gates to new vistas and previously undreamed of opportunities and privileges for all kinds of people. And I want to say that I was very happy to play a part in that revolution. It is one of the fondest memories of my life that I was a member of the petroleum industry in those exciting days when we helped get the automobile started as the American family's version of the magic carpet."

★ *Known U. S. oil fields may eventually produce about 94½ billion bbl of oil by methods currently in use.*

More Sales, Less Profits

It isn't the amount of business so much that faces the petroleum industry — it's being able to make some money on what is sold. K. S. Adams of Phillips and Walter S. Hallanan of Plymouth both pointed this out specifically in the Outlook article in January. Something has to be done about the price-cost structure.

One early report that verifies this is the statement made by E. D. Brockett, president of British American, in his fourth quarter report to shareholders. His company had a record volume of refined products sales during 1958, but earnings are expected to reach only $20 to $21 million compared to $32 million in 1957. Some of this is due to curtailed demand for Canadian crude oil but rising costs and lower product realization have more effect on earnings. Increasing demand for petroleum products does not necessarily mean increasing profits.

Oil Prices Down, Gas Up in '58

The annual Bureau of Mines preliminary production report showed value of domestic production in all major mineral groupings in 1958 at $16.4 billion on a preliminary basis.

Food distribution is the nation's biggest business, with 1957 sales approaching $48 billion. In that year automobile sales were second — just under $39 billion.

Estimated production of crude petroleum in 1958 was 2,447 million bbl valued at $7.4 billion. The output was 6.7 million bbl per day, 467,000 bbl less than in 1957. This decline reflected lower export demands and a reduction in stocks of crude oil. The average value of crude petroleum at the well in 1958 was $3.01 per bbl, *eight cents less than in 1957.*

Because of smaller production of crude oil, the yearly output of natural gasoline declined to about 5,543 million gal, compared with 5,734 million in 1957. The 1958 value was $407 million, down $7 million from 1957. Liquefied petroleum gas production and value increased slightly. Production in 1958 was 6,693 million gal, compared with 6,655 in 1957.

Marketed natural gas increased three percent to 11,015 billion cu ft. This was a much smaller gain than experienced in other recent years. The average value of natural gas at the wellhead continued to increase, averaging 11.7 cents per Mcf, compared to 11.3 cents in 1957.

★ *I cannot give you the formula for success, but I can give you the formula for failure—which is: Try to please everybody.*
—Herbert Bayard Swope

From Victory to Cities

Joseph J. Eley, who wrote that spirited advice on "How to Become Politically Effective" (page E-1) recently sent us an article which he said illustrates the "scope of COPE" (Committee on Political Education of AFL-CIO).

Taken from Ring Industry Employee the piece reads:

TARGET FOR '59: CITY ELECTIONS

In many of the towns in 39 states where this International Union has local branches, this year brings elections for such offices as mayor, city council, school board and other public posts. AFL-CIO's Committee on Political Education has compiled a list of towns with 10,000 population or more where city elections will be held in these states (see below) totalling about 600 in number. A large number of lesser communities will also vote this year.

Organized labor, having scored handsomely in the 1958 campaign, needs now to turn its attention to the 1959 elections. Candidates for these offices will be named within the next three or four months. It's time working people made their feelings felt about who they want to support in either party. We can get liberal city administrations, too, if we'll register and vote this year as we did in '58!

Below this was a list of states, the number of elections in cities of 10,000 and a column of principal cities electing officials in 1959.

It seems the AFL-CIO will not be content until it is the power that elects and controls national, state and local governments.

Analysis made by Congressional Quarterly using the voting test of COPE and the spending reports on file on Capitol Hill shows that on the basis of whom AFL-CIO contributed money to, the labor friends-and-foes breakdown in the Senate works out to 64-32 in labor's favor.

Again on the basis of whom labor supported in the House races and their election victories, that margin is about 234-177 in favor of labor.

★ *When I was a boy I used to do what my father wanted. Now I have to do what my boy wants. My problem is: When am I going to do what I want?* —Sam Levenson

Interest Quickens

One of our favorite correspondents is Sr. Cándido Aceves of Madrid. He is a one-man chamber of commerce oil committee for Spain. Although not in the oil business, he has followed and reported the encouraging provisions of the new petroleum law and other events in Spain's oil operations.

Sr. Aceves complimented us on the Bolivian article in the December issue and suggested one on Argentina. He'll find it this month, beginning on page B-73. He is also looking forward to the time when Spain will have as many companies holding concessions as Bolivia has now.

Our correspondent also sent us a clipping from a Madrid newspaper about operations (which he kindly translated.) It reads:

Bilbao 8. "Drilling operations carried out by a private enterprise under the technical direction of German experts, have started in the town of Aloria, close to the limit between the provinces of Alava and Vizcaya. Around 30 people, German and Spaniards, work continuously, day and night, in three shifts. They have erected an 18 meter tower, have already drilled 60 meters and have the aim of reaching 1.000 or even 4.000 meters.

"There are expectations that greater drilling activities will be carried out in the town of Villa de los Tiestos.

"According to the Engineer Jose Maria Marchesi, most of the Northern Spanish Coast offers characteristics similar to the Californian one known as "San Andres Fault."

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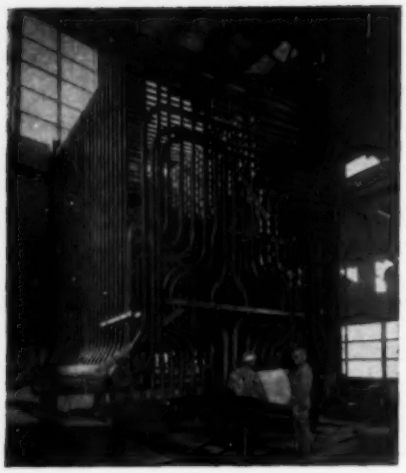

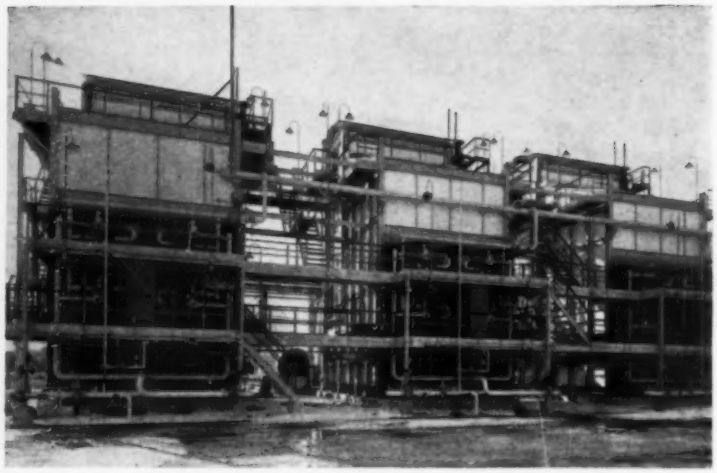

AT LEFT: Installing a 60,000 lbs/hr unit in a brewery

ABOVE: A battery of 125,000 lbs/hr units in a chemical plant

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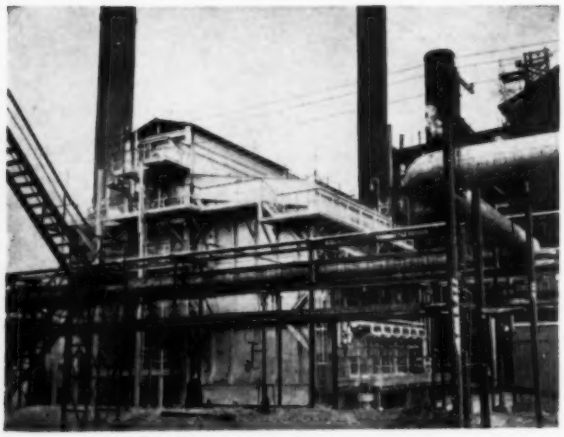
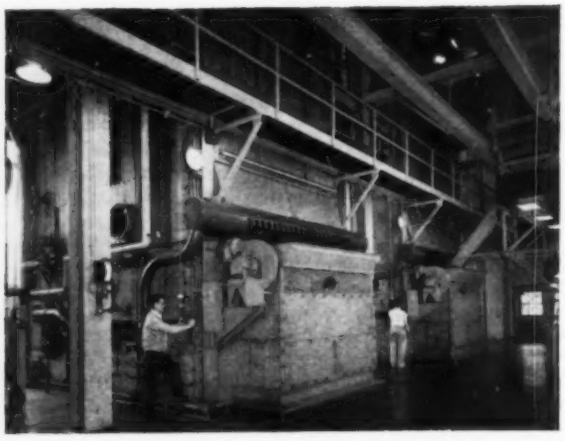
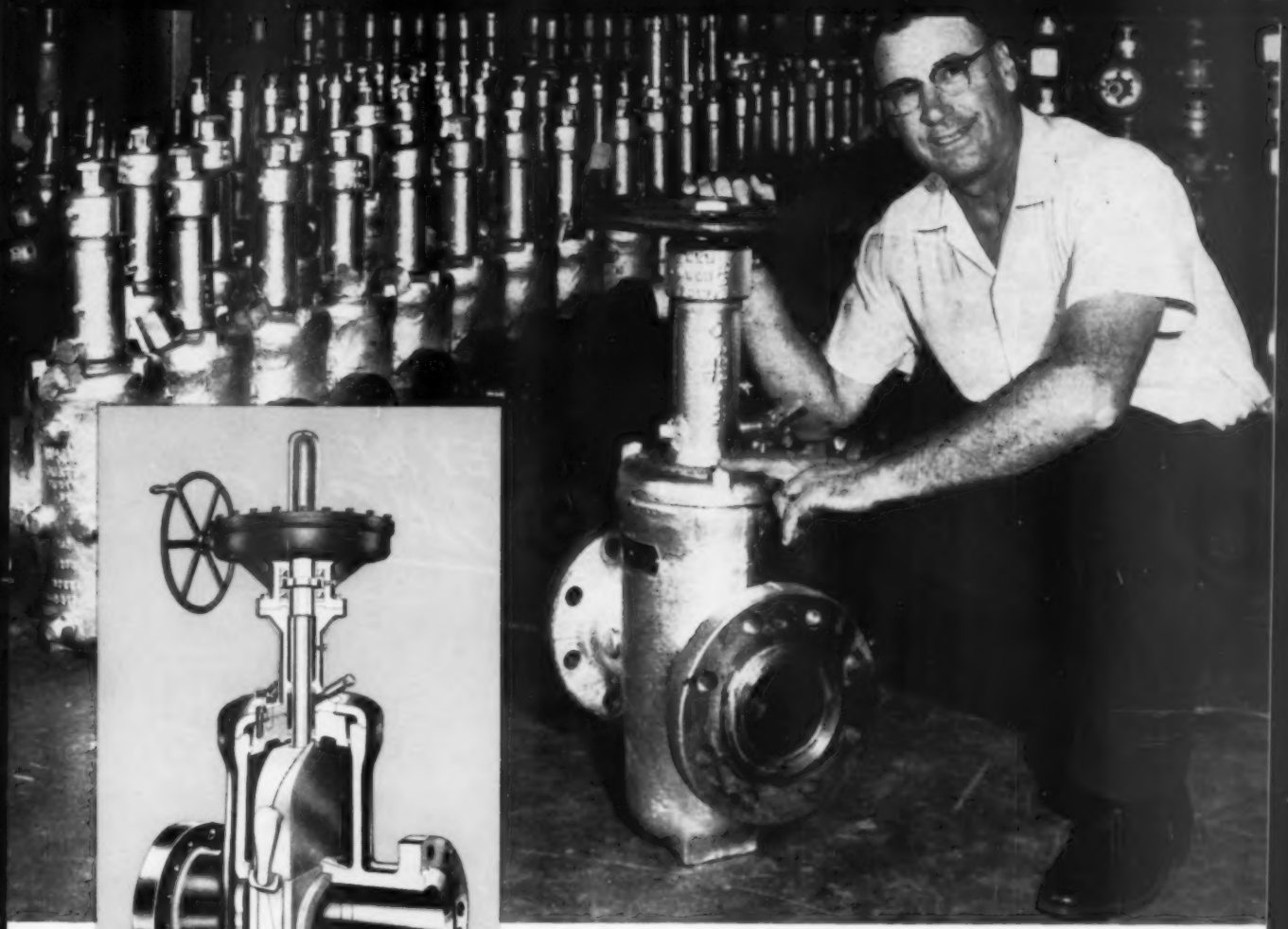
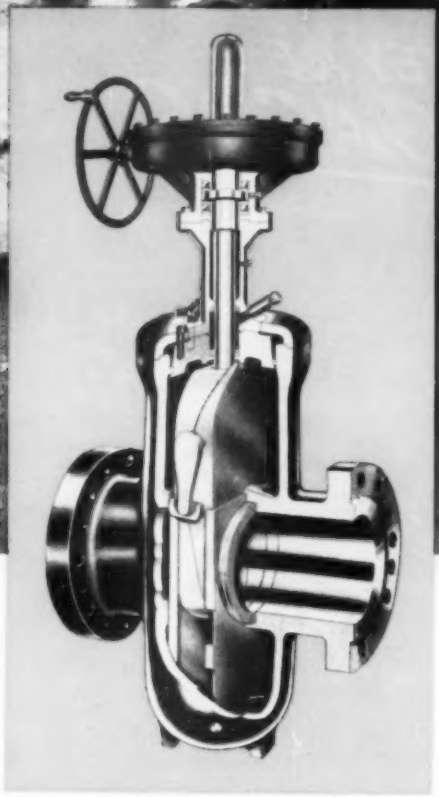


This 400,000 lbs/hr unit is installed in a leading petroleum refinery



Three 40,000 lbs/hr units serve a medical center





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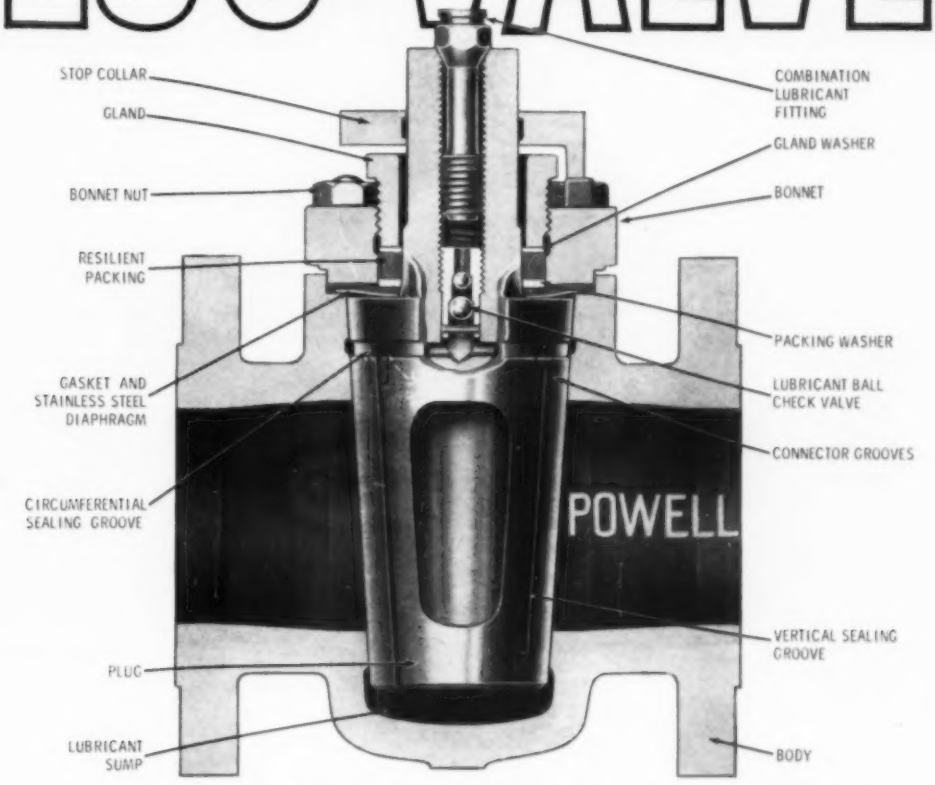

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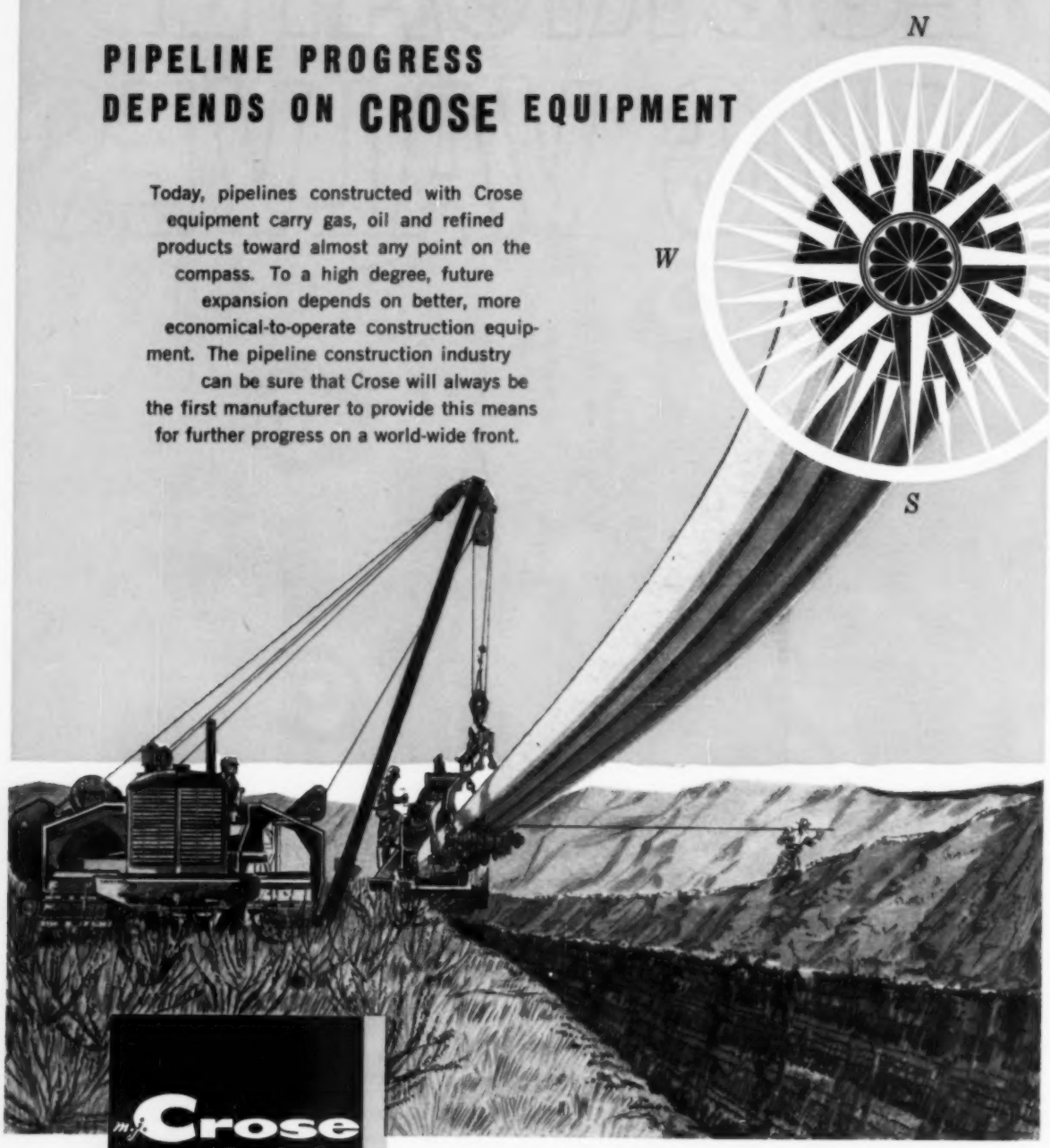

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Joseph J. Eley

"BUSINESS IN POLITICS" has become a major theme of every meeting of businessmen across the country. During the political campaigns preceding November 4, 1958, there were indications of a growing interest in matters political impelled by the uneasy feeling that Big Labor was about to flex its political biceps. Since the gray dawn of November 5, there are few business leaders who will deny that "something must be done."

There is considerable justification for the "something must be done" attitude. Not since the days of the New Deal has there been such a concentration of anti-business sentiment as there will be in the 86th Congress. Adding to the concern is the fact that the unparalleled political machine put together by the America for Democratic Action liberals and Big Labor conceivably could steamroller to a Presidential victory in 1960 and at the same time add to its majorities in Congress and begin concentrating on state legislatures.

At the moment, there is no political force to balance the coalition and provide a choice for the American people. There is a real danger that the American political system, including both parties, may be completely inundated by one economic segment and one philosophy.

The "something that must be done" is the activation and motivation of capitalist-minded individuals to become active in political party affairs, to bring their articulateness and influence on the nominating process as well as the elective process. This has been a fundamental error of business-oriented people in the past. They have allowed someone else to choose the candidates, so that when the final election came, the choice was often a tweedle-dum tweedle-dee affair.

The challenge facing business is to correct the balance in the political scales; to see that the capitalistic economic idea is represented in the electoral process. This, one assumes, is what the many discussions of business in politics is all about.

If the discussions and show of interest are short of some definite changes in attitude on the part of business leaders, we are in for serious trouble. If business on the other hand has finally recognized that the hour is late and the time for action has come, there is still hope.

Among the new attitudes which must develop is a realistic point of view toward the political parties. The old idea that the destiny of the business system can be entrusted to one political party or the other is dead. Businessmen are beginning to suspect that Republican New Dealism is no different than Democratic New Dealism.

The current state of the political parties has made politics an even more complex matter than usual. If the parties were philosophy-oriented so that one represented Socialism (even in the Fabian or Gradualist form) and the other represented Capitalism, the procedures would be relatively simple. However, neither party is all one thing or the other.

The ADA-COPE coalition, most frequently found supporting candidates of the Democratic Party but often found behind Republicans, is committed to a course of Fabian Socialism, which in the current lexicon is termed "liberalism." Obviously, at this point the "liberals" are winning.

Through a combination of well planned and effectively conducted communications and political operations, the coalition has succeeded in popularizing many socialist notions so that we presently have a one-part capitalist, one-part socialist economy.

In a great many states, the coalition has taken control of the Democratic Party machinery and reflects programs of the nature that have deluded many of the world's past civilizations. This is the sweet-smelling promise of "bread and circuses, entertainment without price, security without work." All of this is supposed to prove that the Democratic Party is the party of the "little man."

The Republican Party has become a two-headed creature, one head frantically cries "me, too" to the "liberal" chorus while the other feverishly searches for a place to go. From time to time, Mr. Reuther, Mrs. Roosevelt or one of their comrades-in-arms of the coalition drags out the Halloween mask of Big Business and places it on the GOP but the mask is old, tattered and fits badly.

The results of the 1958 Congressional elections have been reviewed sufficiently to indicate the overwhelming strength

The Author

Joseph J. Eley, *president of Public Affairs Counsellors, Inc., a management consultation firm on political and citizenship affairs, is a former newsman, editor, Chamber of Commerce manager and public relations executive. He served as director of publicity and publications for Freedoms Foundation at Valley Forge, after which he served with the public relations firm of Bozell and Jacobs in New York.*

As executive vice president of Effective Citizens Organization, in collaboration with F. Clifton White, his present partner, he developed the ECO program and direction of practical politics seminars for businessmen on university and college campuses, including Princeton, Stanford, Michigan State, Southern Methodist, and Southern California. He has been active in political campaigns at local and state levels.

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of the coalitions' political machine. One story which escaped national attention lies in the fact that of 16 Senators on the COPE purge list only four will return to the Senate.

Three of the "important" Republican victories, those of Governor-elect Rockefeller of New York, Governor-elect Hatfield of Oregon and Senator-elect Scott of Pennsylvania, were won by avowed members of the GOP's liberal wing.

The fact is that business has no party because it has little, if any, political potency. Nor is the business community sufficiently well organized in terms of corporate affiliations (and cannot be) to be an effective political force in the sense that labor is. There is no disciplined structure in the business community as there is in labor.

Must Motivate Management

What business does have is the great reservoir of people who are not subjected to the repetitious propaganda of the ADA-Big Labor combine and who have the greatest stake in the survival of capitalism. These are the people of management ranks from supervisory level to top management.

It is this segment that business needs to motivate and activate to political action; these people who believe in capitalism on the basis of recognition of the economic facts of life.

The matter of activating management personnel to become effectively active in politics is not a difficult matter. The first step which must be taken in the corporation is to establish a corporate policy which encourages *all* employees to be active, each in the party of his choice.

For years, some corporations have had implicit or explicit policies precluding political participation by management people. There was the feeling that a man who became a county leader, for example, might be engaged in a controversial situation and might be identified with the company in these circumstances. His words and deeds might be interpreted as reflecting corporate policy. There was a time when business could afford the luxury of such policies; that time is passed .

In other cases, the man himself might avoid politics lest he be caught in some set of circumstances that might place him in conflict with his corporate superiors. The combination of attitudes unfortunately resulted in relatively few people of genuine understanding of the capitalist economy being influential in political affairs.

State Political Policy

In order to eliminate past policies of the described nature and to clear up misinterpretations, the company which has decided to face political facts should state unequivocally a policy encouraging political participation and should back up the policy with visible signs of support. The policy should also make clear that a reasonable amount of time off for political affairs will be available. This should be examined in the light of policies covering time off for Community Chest, Service Club, and similar activities.

Once the policy decision is made, the next step is the adoption by the company of a program which will provide an opportunity for management personnel to learn about politics. This is necessary because politics has become an intricate matter. The untrained neophyte who goes into the political arena is like a fleecy lamb going to the shears. As economics is taught in some corporations, so politics needs to be taught through a formalized teaching process.

Teach Practical Politics

The politics referred to here is not the course of high school days called "civics" nor the speculative, reform-oriented political science of the college campus. This is "nuts and bolts" politics, the hard, down-to-earth facts of who does what and why.

This is the politics of the precinct and ward leader and the county chairman; of the factional struggles for control of nominating processes. It is the business of circulating petitions, running primary elections, controlling the mechanics of caucuses and conventions and choosing delegates to those meetings. There are such courses being conducted in some corporations currently and similar courses are expertly conducted by labor.

The ideal process is one through which a class of 30 to 40 people is formed and given a three-day course on company time and in-plant. The subject matter is taught in such a way as to indicate why the individual should be politically active, what he ought to know to be effective and how to be effectively active.

Individual's Stake

At the outset of any such program, it is necessary to point out why people ought to be active in politics. Motivation should be keyed to the individual's stake in political affairs and the philosophy of government as it affects him. He should not be expected to give time and effort to politics to save the dear ol' Widgets Corporation from socialism. Instead, his self-interests should be explained; it should be pointed out that his life and the lives of his family are intimately affected by government. He pays taxes; his home is affected by zoning laws, his children are influenced by schools, the price of his food and clothing are subject to government action of one type or another; there is no phase of his life including his job that is free of governmental influence. The question that must be posed to him is whether he is content to allow others to make the wide range of decisions for him or whether he recognizes the advisability of participating in those decisions.

In addition to motivation discussion course material includes descriptions of the structure and operations of the political parties at the precinct to county level, the county to state level and the national level. The emphasis, of course, is on the precinct level. The method through which precinct leadership is selected and the job description of the precinct leader are important elements of this discussion.

Since the legal basis of politics and the political parties is rooted in the statutes of the various states, it is important that politics be taught in the context of the particular state's legal provisions. Virginia election procedures are far different from those of Wisconsin; New York's electoral methods are totally dissimilar to those of California; Texas and Oklahoma use different techniques.

Orient Political Process

The importance of local treatment of the subject is further

underlined by the fact that due to practical circumstances which legal prescriptions cannot treat, informal political practices develop in most of the communities of the nation. If the "student" is to be effective, he must be made aware of these matters.

The objective of such courses is to activate the man, therefore, the ultimate target is the precinct, since this is where effective political work is done. There must be an explanation of how one goes about "organizing the precinct," and how to canvass. Other techniques include how to compile voter's card files, how to communicate with voters, how to register voters, and how to get out the vote on election day.

The strategy and tactics of caucuses and conventions and party financing are important curricular matters. Campaign techniques and organizing the "team" for telephone campaigns, car pools and baby-sitting are vital parts of the teaching course. In each of these functions there are specific matters to be explored. Even so prosaic a job as baby-sitting takes on special significance as part of the political fabric.

All of the course material points toward what the individual can do. The teaching program is related to the individual, and the technical aspects of political operations. The purpose is to activate people to politics, therefore, politics must be taught realistically; as things are, not as the reform-minded might wish them to be.

No Easy Road

The writer's experience in developing and conducting such classes has resulted in one clear cut conclusion; the job of teaching politics for purposes other than mere mental exercise is a foot-slogging, infantry-type job. There are no glossy packages containing a panacea for the country's political ills and no short cuts.

Politics is made up of people; only people have a real impact on the parties. You can't "package" the aspirations, needs and wants of individuals but by skillful teaching processes you can prod to realization these aspirations, needs and wants and you can show how they can be accomplished through political activities.

Issues Must Be Spelled Out

Concurrent with the citizenship program inside the company there must be constant communications of the company's positions on issues, not only those affecting the company directly but also those which have an indirect affect on the company by their impact on the total economy. The latter, of course, has a bearing on the individual, too. Such matters as inflation, taxes, economy-in-government, subsidies, public power projects, social security expansion, foreign aid and many others ought to be clearly and objectively discussed through the various media of communications with company personnel. Who is more qualified than the company to relate these matters to the capitalist system?

With the two-phased procedure of teaching politics and communicating on issues, it is a certainty that a high percentage of individuals will go to work politically. The results will, incidentally, give rise to additional policy questions.

Almost daily the writer and his associates are asked: "What kind of policy can the company adopt to cover men who run and are elected to legislatures or city councils or any job that requires time off from the job?" There is implicit in this, of course, matters concerning the man's seniority rights, pension program, salary scale, etc.

Treat Each Case Separately

There is no generalized response to this question, of course. Certainly, employees turned officeholders in public positions which require full time, cannot be subsidized by a business. If there is an answer to the question, it lies in the direction for treating each case as a distinct and separate matter. A leave of absence to run for an office is not unreasonable. What is most important is that any policy covering such leaves should clearly cover partisans of both (or all) political parties.

Certainly, a candidate for Congress will require more time off than a candidate for the city council. Either eventuality can be met successfully if the candidate-to-be and management confer and arrange details in advance. Such matters as how much time will be needed in the campaign and how his duties are to be rearranged in his absences need to be discussed.

Again, new problems arise when a man is elected to public office. Certainly his status in such a case should be cleared up in the conference preceding his campaign.

The details depend on the requirements of his office. State legislatures, in most cases, meet for a prescribed period annually or biennially and a leave of absence for the legislative session is a distinct possibility. Most public office functions at the county level and municipal level need not require full time.

More Valuable to Company

There is this to be said on behalf of candidacies and public officeholding. A man who has been through a political campaign — win or lose – is a man of enhanced value to his employer. He is certain to learn a great deal about his community, public affairs and human relations in the political scramble. Even more valuable, of course, is the individual who has served in a legislative or governmental body.

The most important function which needs immediate attention, however, is not the public officeholder aspect of politics. It is the matter of party politics; officeholders have a distinctive way of reflecting the views of the people who are responsible for their nomination and for getting out the votes to elect them. The philosophy of government begins in the political party process; it is here where the opinions and philosophy of capitalist-minded people are needed.

In summary, the company has several roles to play.

First, policies must be established to communicate on political matters, to encourage employees to be active politically and to make necessary and reasonable allowances for time spent on political matters.

Second, the adoption of citizenship training programs is recommended to increase the degree of political sophistication among employees.

Economic System In Jeopardy

Suggestions submitted here represent a radical change in policy for a great many American companies. There appears, however, no alternative to business but to make the change. Politics is a serious business; the stakes are almost always of considerable size. At the present time, one of the chips on the table is the American economic system.

Unless men who advocate the capitalist system begin to play greater roles in politics, the future economic system will be molded by people who are on their records dedicated advocates of socialism, whether they admit their affinity for Marx or not.

The task of corporate leaders is clear:

To prove articulate and intelligent economic guidance.

To cut through the maze of tricky semantics, monetary mishmash and offers to pie-in-the-sky with the truth.

The task of every proponent of sound economic values, self-government and the heritage of Americans is to recognize that the basic ideological struggle is taking place in the political precincts; the future is being decided in the neighborhoods of America. ★ ★ ★

WORLD PETROLEUM INDUSTRY MAKES REPORT

Learned men in petroleum will in the Fifth World Congress reveal their problems and their progress . . . Here engineers and scientists and scores of nations will meet to discuss oil operations and what has been done to improve them

Ernestine Adams

THE PEOPLE OF THE WORLD have inherited the earth and all therein. The most useful heritage they have today is the deposits of petroleum scattered from pole to pole in the earth's rounded vault of treasures.

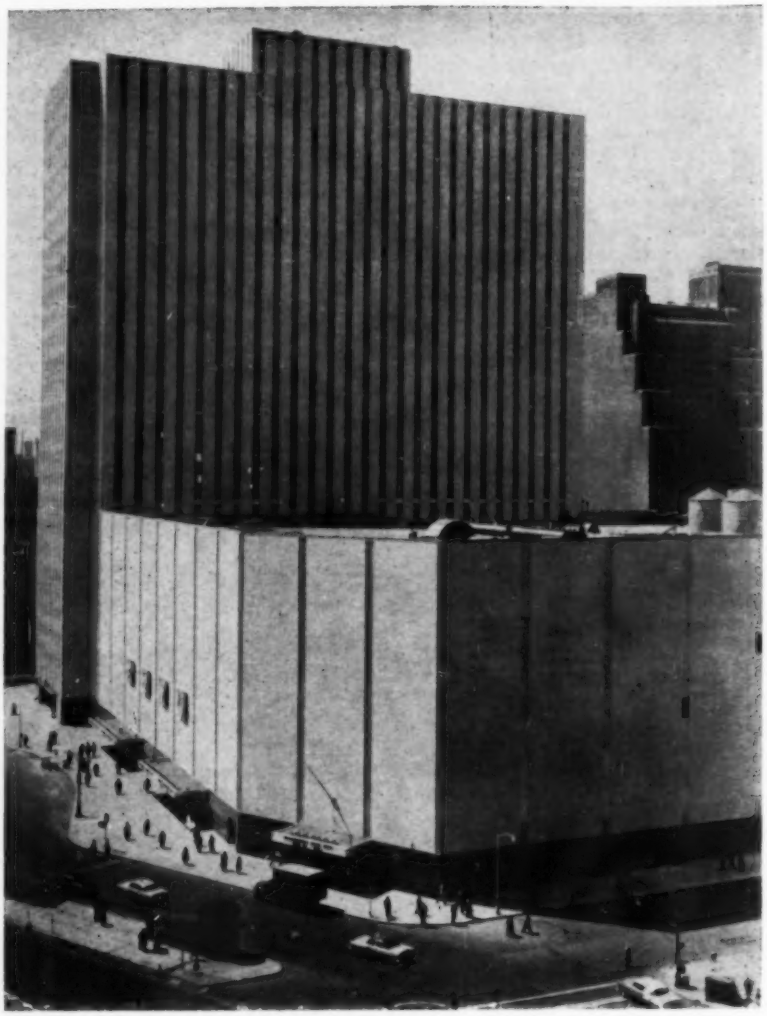
The petroleum industry is custodian of these vast resources and upon occasion it is called to account for its stewardship. Usually this demand for a progress report—or subpoena for records—is in a narrow legal sense imposed by political expediency. In many ways the industry, itself, provides its most comprehensive accounting to the people it serves—through the World Petroleum Congress.

Because the Congress stays outside political boundaries it, too, is a limited report. Its accounting is confined to its scientific stewardship.

Are we using the best scientific knowledge in developing petroleum resources? Is there a better way to conserve our oil and gas deposits? Are we processing efficiently to meet varied demands without building wasteful inventories? These are some of the questions the Fifth World Petroleum Congress will try to answer.

Its objectives are stated thus:

1. **To focus attention on the present status of science and technology in the petroleum industry.**
2. **To further the study of the science and technology of the petroleum and allied industries on an international scale.**
3. **To initiate discussions on all or any technical problems confronting the petroleum industry.**
4. **To provide facilities for the exchange of information between those connected with the scientific and technological development of oil and allied subjects.**
5. **To give scientists and technologists opportunities for making personal contacts with colleagues of many countries.**



Fifth World Congress will meet at New York Coliseum.

Not always has the industry—international and domestic—recognized its responsibility. But the evidence shows that it has been increasingly concerned

Miss Adams is Management Editor

with its job as a service agency to provide energy for greater progress of mankind.

It was 25 years ago—in 1933—that the first World Congress was held in London, sponsored by the Institute of Petroleum. Thomas Dewhurst, Institute president, was chosen president of the Congress. The convention was successful enough to lead to a Second Congress in Paris in 1937 under sponsorship of the Association Francaise des Techniciens du Petrole. Charles Bihoreau was named president. At this meeting a permanent council was established and Congress committees were appointed in the countries taking part. The idea of the committees was to stimulate interest in the Congress and to arrange for presentation of papers.

Congress committees are now in existence in 36 countries: Argentina, Austria, Belgium, Brazil, Canada, Colombia, Denmark, Finland, France, Great Britain, Greece, Germany, Hungary, India, Iran, Israel, Italy, Japan, Mexico, The Netherlands, Norway, Philippines, Portugal, Pakistan, Peru, Rumania, Spain, Sweden, Switzerland, Trinidad, Turkey, the United States, USSR, Uruguay, Venezuela, and Yugoslavia.

The Permanent Council has these members:

USA—E. V. Murphree, Dr. J. McAfee, H. B. Nichols

Mexico—Don Antonio J. Bermudez

Venezuela—Dr. Eduardo Acosta Hermoso

Belgium—C. Bonami, Prof. P. V. Ch. Ercullisse, Prof. F. P. Malschaert.

France—R. Navarre, Prof. H. Weiss, S. Scheer

Italy—Prof. C. Padovani, Prof. G. Roberti, T. Salvadori

Holland—Dr. I. H. Ter Meulen, J. A. Beukers, W. James

Austria—Dr. H. Kupper, Dr. H. G. Waldschutz

Germany—Dr. G. Schlicht, Dr. A. Bentz, Dr. K. Ziegler

Great Britain—Sir Stephen Gibson, Dr. E. B. Evans, Colonel S. J. M. Auld

Canada—Dr. G. W. Gurd

USSR—Prof. A. V. Topchiev, Prof. M. F. Nagiev, Prof. F. A. Trebin

General Secretary—D. A. Hough

Tentative plans were to hold a Third Congress in Berlin in 1940, but the war intervened and it was not until 1949 that the Royal Dutch Institute of Engineers extended an invitation to hold a Congress in The Hague in 1951. The Institute President, Jonkheer Van Lidth de Jeude, became president of the Congress.

The Fourth Congress went to Rome, Italy, in 1955 at the invitation of the Unione Petrolifera. President was Professor Marcello Boldrini.

Interest in the Congress has been increasing as shown by the registration. The first Congress had 1250 registration; the fourth one had 3250 persons registered. Delegates in Rome represented technical organizations in 47 countries.

The Fifth World Congress, which will run from May 30 to June 5, 1959, in New York is expected to draw some 6000 technical and scientific members of oil industries in 50 or more countries.

Invitations to the world oil industry to attend this World Petroleum Congress were extended by Frank M. Porter, president of American Petroleum Institute. E. V. Murphree, chairman of the permanent council of the World Petroleum Congress, is president and chairman of the Fifth World Petroleum Congress, Inc. He is president of Esso Research and Engineering.

H. S. M. Burns, chairman of API and president of Shell Oil, is president of the Fifth Congress and as such will preside at the meeting.

Specialists drawn from all sections of U. S. industry serve on Congress committees. C. Eugene Davis, retired vice president of Shell, is the general secretary. Headquarters have been set up at 527 Madison Avenue, New York City. The Congress, itself, will meet in the Coliseum at Columbus Circle in New York City.

An exposition occupying a large part of the Coliseum will demonstrate the latest developments in oil research, production, refining, and transportation. Scientists will report in English or French, official languages of the Congress, on every phase of the industry.

The technical program has been divided into 10 sections as follows:

Section 1—Geology and Geophysics.

Section 2—Drilling and Production.

Section 3—Oil Processes and Refining.

Section 4—Chemicals from Petroleum and Natural Gas.

Section 5—Composition—Analysis and Testing.

Section 6—Utilization of Petroleum Products.

Section 7—Engineering Equipment and Materials.

Section 8—Transportation and Distribution.

Section 9—Operations Research, Statistics and Education.

Section 10—Applications of Atomic Energy to the Petroleum Industry.

A series of industry tours are being scheduled for the week preceding and the week following the Congress. Full details are to be circulated to potential Congress registrants at the end of October but briefly they have been programmed as follows:

May 21-23—International Petroleum Exposition, Tulsa, Oklahoma.

May 23-30—Tour for geologists through New Mexico, Wyoming, and Montana.

May 25-26 or June 11-12—Sinclair Research Laboratories Inc., Harvey, Illinois; Research Laboratories of Standard Oil Company (Indiana), Whiting, Indiana, and Universal Oil Products Company, Des Plaines, Illinois.

May 28—Brookhaven National Atomic Laboratory, Long Island, New York.

May 29 or June 8—Schlumberger Well Surveying Corporation, Ridgefield, Connecticut. (Half-day visit by groups.)

May 29—Atomic Power Station, Shippingport, Pennsylvania.

May 30 or June 6 or 8—Tidewater Oil Company Refinery, Delaware City, Delaware.

June 7-11—Gulf Coast tour visiting Humble Oil Research Center, Houston, and drilling, crude production and storage facilities at Lake Charles, Mont Belvieu, Liberty, Beaumont, Orange, New Iberia, Avery Island, Morgan City, Leesville and Bay Marchand. The tour will terminate at New Orleans.

June 8-9—Esso Research and Engineering Company's Laboratories, Linden, New Jersey. (Half-day visits by groups.)

June 9-10—Ethyl Corporation's Research Laboratories, Detroit, Michigan; Ford Motor Company's Laboratories and Rouge plant assembly line, Dearborn, Michigan. * * *

Public Relations Is Everybody's Business

8 things to remember if you want to be a good representative for your company and industry

Dr. A. Q. Sartain

DO YOU EVER EXPLAIN to your neighbor that all wells drilled don't strike oil? Have you been able to tell your friends why the petroleum industry needs a depletion allowance? Can you make that new acquaintance understand why the industry is divided on imports?

In other words, are you a good public relations representative for your industry? It is your business, whether you realize it or not. Even if your company is large and has a well organized public relations department—to every person who knows you, you represent your company.

So let's get away from the idea that only the public relations department has relations with the public.

Another discouraging attitude you may have is that one individual counts for little or nothing; that what you do or fail to do makes very little difference in the long run.

The fact is, of course, that these points of view are entirely incorrect. There is no doubt about the importance of the public relations department in modern business, and no one would attempt to take from that department its very responsible functions. But the truth is that public relations is everybody's business.

Suppose that most of the several hundred or maybe thousands of people employed by a company are "sold" on it. If they in turn attempt to sell the company they become a potent force for good company relations in the community or communities in which they live. Nor is there any doubt that these people collectively can do things which damage the reputation and standing of the company far beyond anything that the public relations department can do on a constructive side.

Furthermore, the individual does count. Every individual, no matter what his job, has his circle of friends and acquaintances whom he influences. This, of course, is especially true if one is in a position requiring technical training or is otherwise highly placed in a business. Chances are that such a person has an influence that extends beyond anything he imagines. And all of us exert a degree of influence. That is why we say: Public relations is everybody's business.

In a word, a company has a good public relations program if everyone is doing his job well and selling the company enthusiastically. And it has a poor public relations program, no matter how well developed the department, unless the majority of people are enthusiastic in support of their company.

Let us turn now to the way in which a public relations program can be implemented by the individuals in a company. We are not attempting at this moment to speak to public relations departments. These people have their own specialties and these are well developed. We are concerned with how the average individual, who has nothing to do with the public relations department, represents his company.

Be objective

1. Be Objective

In the first place, it is important that you as the employee be objective and realistic in your appraisals. All of us, of course, are inclined to believe that this is a problem of the other person and not one of ours. *He* may decide on the basis of feelings, but *we* decide on the basis of the facts, on the basis of the situation as it is.

Actually, we are all tempted along this line and from time to time we succumb to temptation. We permit our feelings and our desires to overwhelm our ability to make careful decisions—but when we do so we run the risk of being poor representatives.

If a person is going to be a good public relations representative of his company he certainly needs a degree of objectivity about the situations in which the company is involved. Conclusions should be based on facts and not feelings.

Incidentally, there is no reason why one should avoid or fear objectivity in the oil industry. It has something worthwhile to sell, and has made tremendous contributions, not only to the economy of the oil-producing regions, but to our economy as a whole.

There is the romance of oil — the great adventure there is in exploring for oil, and producing, refining, and marketing oil. There are also taxes paid by the oil and gas companies and related companies, taxes that benefit everyone. A person who works for an oil company has a good product to sell. With objectivity and sincerity he can sell that product much better.

2. Don't 'Trick' People

Next to the ease with which we deceive ourselves about our unbiased outlook is the readiness with which we fall for the use of "tricks." We get the idea that effectively influencing people consists primarily in a set of tricks or techniques which you use on them. We're all familiar with this kind of thing. There are ways in which you approach people, or so it is sometimes believed, which make it difficult or almost impossible for them to fail to do what we want.

You learn a man's name and then carefully use the name in discussing things with him later. You get him in the habit of saying "yes." You use other tricks, by means of which you attempt to condition this individual. After that he is supposed to do, or believe, as you wish him to.

Under certain circumstances, it must be confessed, these tricks work. But ordinarily these circumstances are the ones in which you have minor and short-term contacts with the individual in question, and even then there is serious question about their "batting average." If, on the other hand, the person is one whom you will work with for a long period, or one in whom you are trying to bring about a fundamental change in attitude or belief, it is extremely important that you not give him the impression that you're trying to "pull the wool over his eyes" or to use tricks in any objectionable sense.

If then your purpose is to sell the company effectively to people whom you know well and with whom you have frequent contacts, tricks are to be avoided. Sooner or later you will be found out and after that the tricks not only fail to work, but people lose respect for you as an individual who injects a somewhat false or questionable practice into a friendly relationship.

3. Keep Informed

Another thing you need to be effective in your own personal public relations is to be well informed. You need information, sometimes a great deal of it, about current problems in the oil industry. It is rather striking how many people in the industry have only a little knowledge about some of them.

Incidentally, these are not only hourly-rated people or those in the lower ranges of salary. Often they are people in technical and management positions.

Let's take an example. Here is this matter of the depletion allowance. How effectively could you, if called upon to do so, explain exactly what the depletion allowance is, and just why a certain percentage of depletion is allowed? In particular, why is depletion allowance not only desirable but essential in the oil industry? This item is one of extreme importance today, as the increasing number of congressmen willing to vote to reduce or eliminate the depletion allowance will testify.

Don't argue

Another example is the control by the Federal Power Commission of the price of natural gas. Under what circumstances did the FPC get this authority? Precisely what does it mean? How far does this control go? In what way are prices going to be determined by the FPC? What is your company's position on this problem? What is your own? Is your position based on fact or feeling?

If you are an effective representative of your company and industry you must know the answers to these and to many other questions.

Another surprise to an outsider is that many in the industry apparently believe it is impossible to tell the industry's story effectively. They seem to think you can't explain to the average employee of the company or to an interested outsider the intricacies of these problems.

Obviously, the tasks faced by the industry in these areas are formidable ones and cannot be handled easily, but there are elementary facts that practically every person in every company should know and understand well enough to be able to answer questions when the occasion arises.

4. Don't Argue

To be effective in public relations we must, as already said, do a good job of selling. We must recognize that as advocates of the oil industry and of our companies our job is not simply to present the facts. Of course, it is important to be familiar with the facts and, on occasion, extremely important to present them. But we need not only to present the facts, we need to select the facts to be presented and to present them in an appealing and convincing way.

For example, if you wish to convince a person it is best not to argue with him. Facts may be presented objectively but attempting to out-talk, out-think, or demolish the other side rarely convinces the other side.

What is the usual effect of argument on the person with whom we argue? The answer is clear. In the great majority of cases no one wins an argument and seldom does it succeed in changing opinion or getting conviction on the part of other persons. Usually when we argue with another person we force him to take a position, or if he has taken a certain position already, we force him to defend it more vigorously and emphatically. Not only that, but as the argument progresses the chances are we force him also into a more extreme form of his position.

Your verbal adversary finds himself in a position where he has made a statement and now must either say "I was wrong" or else seriously attempt to defend it. What do we ordinarily do under these circumstances? It's very difficult to say "I was wrong" and admit this to the public and the world. Rather than do this, we ordinarily defend ourselves even to the bitter end.

What is another and better way to handle this situation? The answer is simple—hear him out. Get his objections, his point of view, out in the open.

Two fortunate results are likely to occur if you encourage him to talk and express these feelings and objections. One is that he may actually talk himself out of them. We have all had the experience of having a problem that has bothered us for a long time, each day apparently becoming more serious, until we find a listener who can and does listen effectively. Frequently under these circumstances we come to recognize that the problem was not as serious or our point of view not as divergent as we had been inclined to believe. We may actually solve this problem by talking about it or we may get emotional release simply from the talk — afterward be better able to live with it.

There is another likely result.

Through these procedures you get objections out into the open, where you can come to understand and deal with them. This is, perhaps the fundamental difference between low-pressure selling and high-pressure selling.

In high-pressure selling you attempt to overwhelm the prospective customer, and get him to sign on the dotted line whether he is thoroughly convinced or not. You get this signature if you can before he has a chance to change his mind.

In low-pressure selling, on the other hand, you give the individual every opportunity to think the matter through thoroughly. You give him a chance to talk about his objections; you encourage him to state the objections; and then if he does not convince himself of their lack of validity you at least know more about his state of mind and can deal with him more effectively.

Incidentally, we hear a good deal these days, as we have for a long time, about letting sleeping dogs lie. There's a feeling that somehow that if we don't let a person talk about a certain objection to a point of view, he won't have it—it will go away. On occasions there may be truth in this old adage, but in the main it is entirely incorrect. In most instances we do not let sleeping dogs lie, they are not lying in the first place. They simply do not bark when we (or the boss) happen to be around.

The truth is that we seldom create objections by letting people talk about them. We seldom solidify people in their positions by listening to them. On the contrary, "letting them get it off their chests" may to them be the best first step in convincing a person of an opposite point of view.

Sometimes, of course, in an apparent argument we are not trying to convince the person with whom we are arguing but are actually trying to convince others who may be listening. So far as the particular person is concerned we may have "written him off," decided that we cannot win him over. Then we may use him as a whipping boy or an example and by talking to him, and through him, may succeed in talking to other people. When this is not the case, to argue is to be ineffective.

5. Don't Be a 'Know-It-All'

To sell most effectively we must avoid giving the impression that we think we know all there is to know about a subject. Actually in most instances we do not. Even if we do, bragging will not help. Take this matter of depletion allowance. You may understand the circumstances under which the provision was originally written into the Internal Revenue Code, why it works for oil companies, and the great importance of continuing it. But there are probably things about depletion allowance that you do not know. The same thing can be said with regard to almost any subject. Don't pretend to know it all because you *don't* know it all.

But more important for public relations is the fact that if you pretend to another person to be a "know-it-all," an expert in this objectionable sense of the term, your chances of really convincing him are slight. They will diminish pretty largely in proportion to his belief that you feel that you are superior to him. A feeling that the person to be convinced is somehow unworthy or inherently inferior to you destroys any real influence over him.

Possible strategy would be something like this. Tell him, "There may be something to what you say, but have you considered *this?*" Or begin a discussion of a point by admitting the limitations. We do not need to depreciate our own knowledge but we can often win over a person by poking some fun at ourselves. We do not pretend that we are the only person who ever had an idea on the subject, or that we are in any sense the final authority.

It is clear, of course, that this point demands a certain degree of humility on our part, but it is not the Casper Milquetoast kind of humility. It is not the humility which leads us to have no opinion and to be unable to express forcefully what we have in mind. Rather, it is the kind of humility that keeps one aware of his human frailties and at the same time makes him understand that people respond best when we treat them as human beings and recognize them as creatures of dignity and worth.

6. Don't Pretend to be Perfect

A closely related point is that you do not need to pretend that either you, the company, or the industry is always right and without fault. Surely the oil industry, in general, and your company, in particular, and you as an individual have made mistakes in the past.

Even today there may be some company policies and practices with which you as an employee do not agree. But you do not have to agree with everything the company says, does, and practices in order to defend the company. You do not even have to agree with the company's point of view in order to sell that point of view.

One thing is basic here, of course: You do have to believe in the company as a whole and feel that fundamentally it is going in the right direction. If you do not, you ought to take steps either to change the situation, if this is possible, or to find a job elsewhere.

The point is not to encourage or advocate any sort of disloyalty to the company, but to realize you do not have to agree with every jot and tittle of

Don't pretend to be perfect

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nuclear and electronic research

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what's being done in order to defend your company. A basic loyalty to the company and a belief in it overall enables us to defend it even though we are not always sure it acts wisely.

Nobody can expect everyone to agree with everything the company says and does. Being the result of human efforts, the company is wrong at times. But being willing to admit that no human enterprise is perfect, that the company can make mistakes may actually make you a more convincing representative of the company on important issues.

7. Use Empathy

A vital help to good personal public relations is the use of empathy. This is a term that is not in common usage, but a valuable one once we understand its meaning. Empathy means the ability to put yourself in the other fellow's place, to understand how he thinks and feels, but at the same time to maintain your own objectivity, your ability to decide on the basis of facts and not feelings.

Empathy must be distinguished from sympathy, the latter meaning to know how the other person feels and to feel that way yourself. Sympathy lacks the objectivity which empathy demands, or permits.

Perhaps an illustration would be in order. Here is a person quite unlike you in background, attitudes, and experience. For example, you are a college graduate with training in a technical field, and he is a craft supervisor who "came up the hard way." Or he is an active advocate of the union and perhaps an officer at present, while you have always identified yourself and associated with management people. Or she is a mature, capable, ambitious woman who is making the oil business a career and is anxious to get ahead.

How does the world look to a craft supervisor, a shop steward, or a secretary? Needless to say, this is a question difficult for you to answer without conscious, practiced effort. Such effort must continue over a long period, during which you will come to wrong conclusions on many occasions.

The practice of empathy is extremely important if one attempts to change the ideals, attitudes, and beliefs of another person, especially of a person who thinks and feels quite differently from oneself. To be successful in such an effort realistic empathizing with the other person is usually a necessity.

8. Be a Good Listener

In closing, we need to stress again the importance of skill in drawing the other person out. If you are always in a position to give an order and see it is carried out, this sort of skill may be of secondary importance. In attempting to change beliefs or secure conviction, however, commands, threats, and even bribery are ineffective. (They may lead to change in conduct; they seldom bring about change in belief.)

In this situation the person who shows a wholesome concern for the other individual, who demonstrates a willingness or even an active desire to understand him and his views, and who gives him a chance to state them and talk about them, has a much better chance of accomplishing his objective.

To draw another person out effectively requires a great deal of restraint and patience on the part of the person who attempts to do it. Furthermore, it requires careful planning and many skills which unfortunately may run contrary to our established habits. These are skills which are learned slowly and with difficulty. But there is no substitute in good personal public relations for these skills of listening understandingly to the other person.

There are the eight attitudes and skills you must gain to be effective for yourself and your company in relations with the public. Put them down and check them over. How many can you answer satisfactorily?

1. Are you objective in your appraisals?
2. Do you use tricks to influence people?
3. Do you keep informed?
4. Do you try to outargue your opposition?
5. Do you act like a "know - it - all" person?
6. Do you pretend every person and thing you are for is always right?
7. Can you use empathy?
8. Are you a good listener?

* * *

Be a good listener

Read Faster, Read Better

If you are an executive you now spend at least two hours a day reading office memos, correspondence, and reports. This new approach to reading can speed you through your paper work in seven-league boots

Arthur Herzog

[To test your reading speed, note the time as you begin.]

NOWADAYS, a large number of able business and professional men are spending their spare time at what, five years ago, would have been considered an odd occupation: Learning to read. If this sounds extreme, consider the problem. In recent years the bulk of printed material that arrives at the executive desk has so increased that it seems to be brought by an invisible conveyer belt. Except for the wastebasket, the usual executive has only one defense against this mountain of paper—a set of reading skills which, like his handwriting, stopped developing in the sixth grade.

One of the exponents of the new ideas on reading is Nila Banton Smith, author of the recently-published Prentice-Hall book, *Read Faster—and Get More from Your Reading*. A lightning-fast reader herself, Dr. Smith consumes a novel at 1200 words per minute. As Director of the Reading Institute of New York University, she supervises the reading instruction of some 2500 students, from 7 to 70, all of whom want to—indeed, many of whom must, to stay in school or on the job—read faster and better.

Mechanical Methods Not Enough

Contrary to some earlier specialists on the subject, Dr. Smith does not believe that reading can be adequately taught in terms of eye movement, eye span or any of the other mechanical methods that are still fashionable in some other places. To her, reading is thinking, and anyone who wants to improve his reading must concentrate on the dynamics of his reading mind. Not that the Reading Institute isn't equipped with various mechanical devices. But they are usually exhibited only to prove to the student that the Institute knows such equipment is available.

Skilled reading, according to Dr. Smith, is an absolute necessity for the modern business or professional man if he is to keep up in his work or in his cultural life. The average reader plods along at 200 to 250 words per minute, which means that a reading of, say, *By Love Possessed*, which is 245,942 words long, would take over 20 hours, a fact that may partly explain why bookstores declare it is the least-read best seller in years. The ordinary business executive spends, according to corporation presidents who discussed the matter at a meeting of the American Management Association, not less than 25 percent and up to 75 percent of his working day on the memos, correspondence, financial reports, bulletins, advertising material, trade journals and plans that accumulate on his desk. On other levels of business, employees spend an average of two hours a day reading. Thus, businessmen who have succeeded in making themselves or their employees read faster have soon learned they have a considerable saving in man-hours, convertible into cash.

Skilled Reader Understands Better

But there is more to skilled reading than speed. A popular idea has it that slow readers comprehend and remember better, a myth probably spread by slow readers to defend themselves. Not only will a skilled reader move faster down the page, but he will also comprehend better than the word-chewer. He is a reader trained to pick out essential ideas, form them into consistent wholes and see what he is reading as an organized entity. Because his speed enables him to read so much, he can keep up with the latest thinking in his field. And he is a critical reader, in the highest sense, for he

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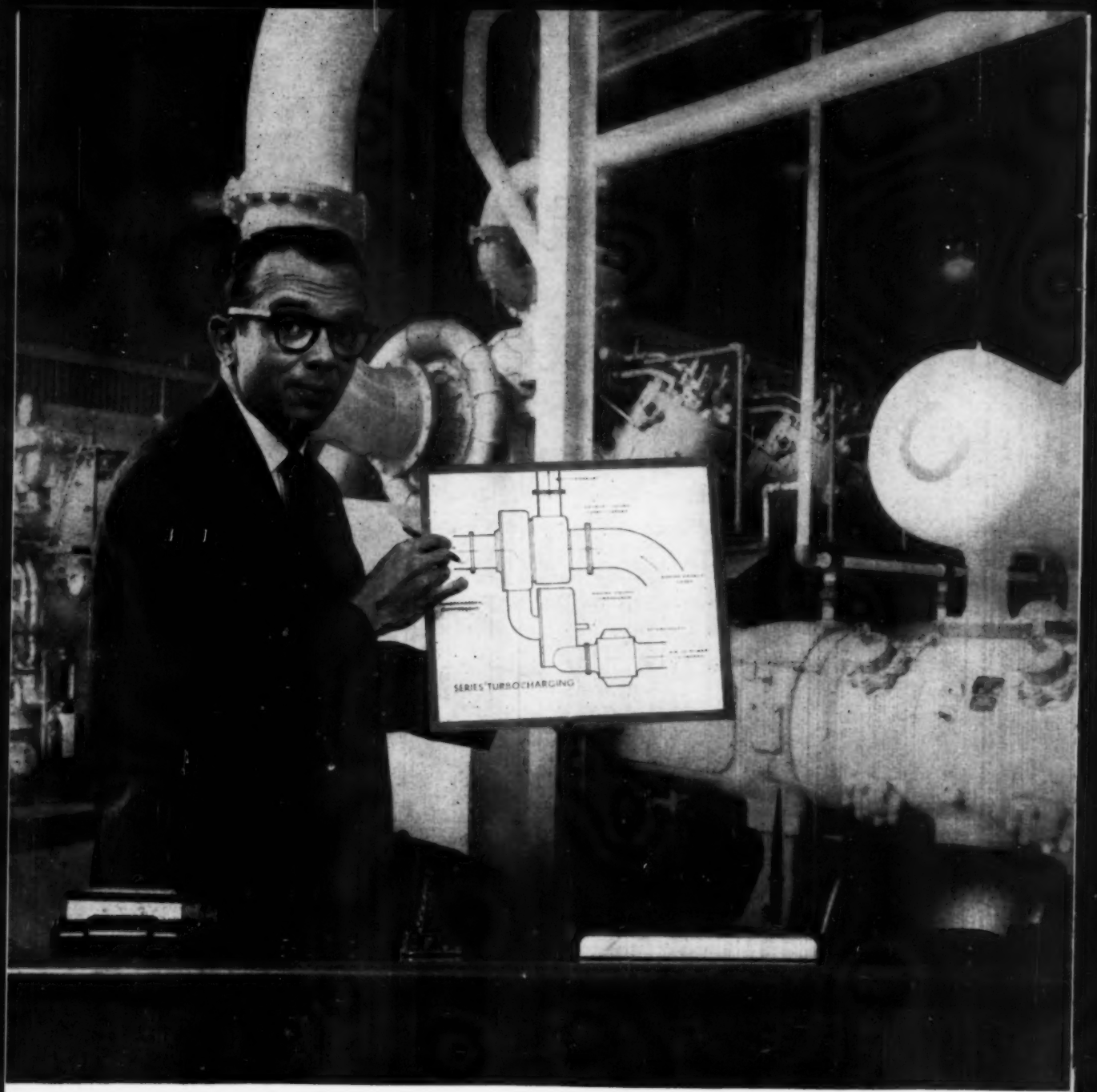
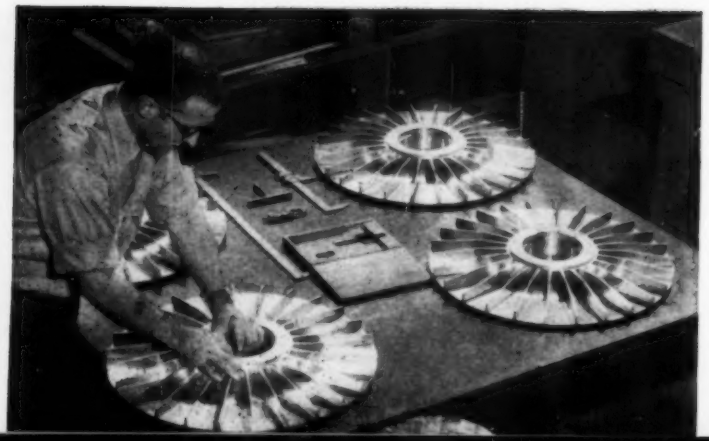
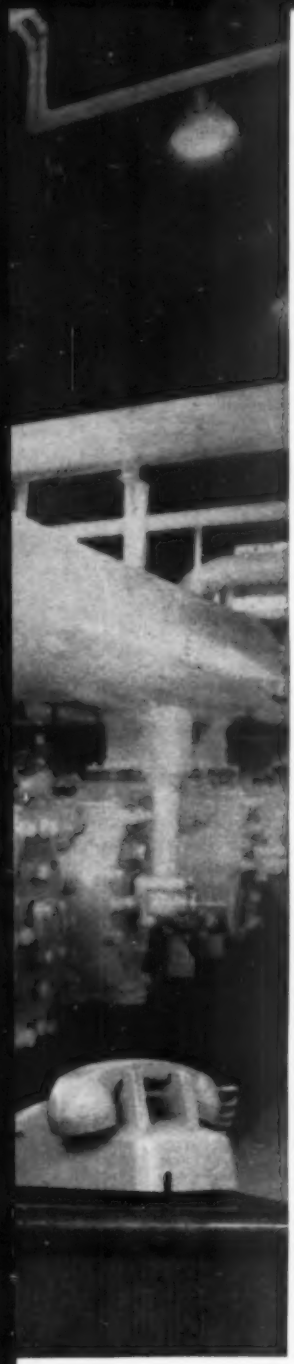




Built Entirely By Cooper-Bessemer. Cooper-Bessemer is able to ideally integrate turbocharger system and compressor engine performance . . . and to assure highest standards of materials and workmanship for these precision components.



Donald L. Reed, *Manager Gas Engine Compressor Sales, The Cooper-Bessemer Corporation, explains . . .*

How you get 40% more power with the latest Cooper-Bessemer V-Angle Compressors

The diagram explains Cooper-Bessemer's series turbocharging development. A step beyond ordinary turbocharging, *series turbocharging* assures an extra performance margin throughout the operating range, plus these unmatched advantages:

40% greater horsepower than predecessors of the same bore, stroke and speed.

Reduced fuel consumption . . . as low as 6900 Btu/bhp/hr—proof of series turbocharging's greater efficiency.

Space savings. Greater output, combined with inherent compactness of V-angle design, results in lowest cost per horsepower for housing, foundation, piping, maintenance, supervision.

Superior altitude performance. Inherent flexibility of the series turbocharging system allows unique altitude compensation to assure full rated horsepower and highest efficiency.

Full range response. The Cooper-Bessemer series turbocharging principle *automatically* provides optimum supercharging regardless of the degree of load.

WRITE FOR BULLETINS . . . complete details on Cooper-Bessemer Series Turbocharged V-Angle Compressors in GMVC Bulletin 85 and GMWC Bulletin 86. Free on request.

Latest Bulletins. GMVC Bulletin 85, 1100 to 1800 bhp; GMWC Bulletin 86, 2000 to 3500 bhp.

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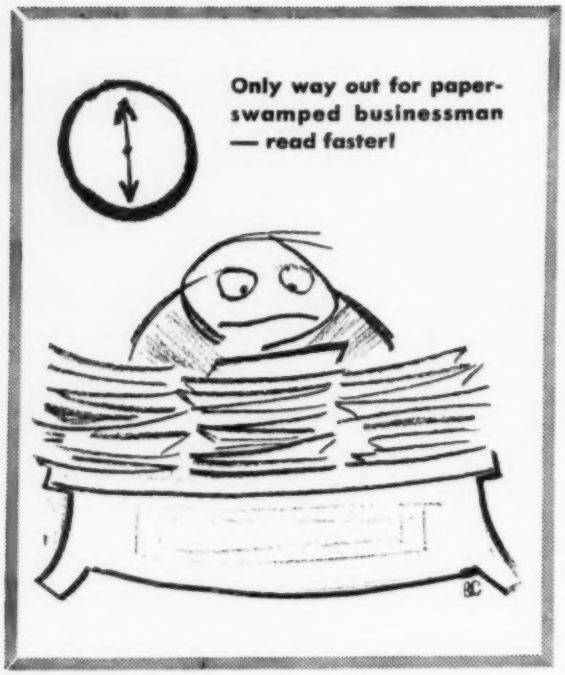

is expertly prepared to evaluate the importance, purpose, truth or bias in what he is reading. And all this at 600 and even 1000 words per minute.

At the heart of Dr. Smith's theory of better reading is the idea that the mind controls all the physical processes that govern the act of reading. The slow reader, for instance, will make 10 to 20 eye jumps per printed line, while the fast reader can cover the same line in two or three jumps. Earlier practitioners of reading skill interpreted this as meaning that to increase speed you had merely to decrease the number of eye jumps, and remedial reading students were trained to read with their *eyes*. The result was eyestrain and confusion, but little permanent increase in speed or comprehension, because, as Dr. Smith explains it, they were treating symptoms, not the cause. The real trick is to make the *mind* read effectively. When it is doing so, eye jumps and the like will take care of themselves.

The trouble with the average adult reader is that he was taught to read in school by methods inadequate for our present tempo of life, and what he did learn was soon forgotten after the sixth or even the third grade, when reading instruction normally stopped. Almost the only reading skills with which he enters adult life are a knowledge of what common words mean and the habit of reading from left to right.

Dr. Smith first started teaching adult reading in NYU School of Education lab courses 10 years ago. At that time she discovered that with the exception of a few scattered academic works on the subject, there had been no studies of adult reading needs, and there were no tested methods of teaching adult reading. Over the next five years, Dr. Smith developed the techniques on which the courses at the Reading Institute are based, and which are coming into increasing use elsewhere. They are all intended to convert the amateur adult reader into a skilled professional, and in a matter of weeks.

Go As Fast As You Can

As the first step to reading faster, the adult student trains himself to go as fast as he can, never backtracking no matter how strong the temptation. He can pick up much of his new speed simply by learning to read in longer thought units, recognizing entire groups of words instead of picking them out one by one. To accomplish this, he needs to know that sentences are put together with key words and phrases, with the other words and phrases being subsidiaries to the main sense. By following the key words, jumping his eye from one sense group to the next, he soon learns to pause only two or three times to a line, instead of taking the 10 or more little jumps he was accustomed to make.

The good reader begins his assault on the printed page by what Dr. Smith calls previewing. He quickly checks the title, chapter headings, photo captions and the first paragraph for clues as to whether he should bother with the reading at all, and if he should, at what speed and on what levels he should proceed. He is prepared, too, to make that momentarily agonizing decision not to try to master all the facts therein, but merely to look for the essential ideas. The good reader, above all, is the flexible reader; he will have more than one reading speed, and his previewing will tell him in each case what the top possible speed is. The decision made, he sticks to it.

Pluck Out Idea

Previewing accomplished, the reader plunges in, prepared to communicate with the author, not to fight with him. He will find, for instance, that the average English paragraph is constructed on a single important idea, the trick being to find that idea at a glance. Now that idea is there, and the author, if he is worth his salt, has placed it so that the reader can easily find it. The trick for the reader is to eliminate transitions, connections, modifiers, etc., from serious consideration. What should be left are the main subject and verb around which the paragraph is built. After the reader selects this main idea, the subsidiary thoughts fall into place around it, and the reader proceeds to the next paragraph with the clear understanding of what has just been said.

Directional words, too, are extremely valuable in pulling the reader smoothly from one essential idea to the next. "Go-ahead signals," as Dr. Smith calls them, are words like *such as, more, also, likewise, and, moreover* and *furthermore*, all of which advise the reader that there will be no new ideas introduced, no change in the direction of the thought, and he is safe to proceed at top speed. On the other hand, "turnabout" words like *but, yet, otherwise, although* and *on the other hand* warn the reader to pay attention because of the impending change. Signals like these are inserted in writing to make reading easier; yet, most readers ignore them.

Remember What You Need

Remembering details and facts are another problem, and here the solution is to pick out what you want to remember, organize facts and set your mind on laying them away for future use. Knowing how to find the main idea and relate clusters of details to it are fundamental steps in learning to remember what you read, but in addition you must tell your memory emphatically to "take hold of this and keep it for me until I want it." In other words, you need to use all of the important skills taught in the new art of reading and also definitely *will* to remember certain facts that you want to recall.

Writing has been defined—as has art—as shared experience, and since experience varies, writing will, too. There are various patterns of writing that the reader should learn to recognize; for, just as an architect can "read" a blueprint and know much at a glance, the reader should be able to understand the difference between various forms, each of which requires a slightly different reading technique. There is, for instance, the personal experience, in which the writer

New Invention Picks Up 40 Cu. Yd. Detachable Containers . . . 15-Ton Loads

Dinosaur picks up in excess of 30,000 pounds of granular material, white line inside container indicates load has not shifted.

DEMPSTER-DINOSAUR Combines Detachable Container Flexibility With Big Pay-Load Capacity

Unlimited Capacity

The proven savings of mechanically handled detachable containers have now been expanded to cover long, over-the-road hauls. Two DINOSAUR models are available for this work. One, for tandem trucks, handles 30,000 pounds; the other, for single axle trucks, handles 22,000 pounds. Special off-the-road models are available for loads limited only by the capacity of the truck.

For Docks and Flat Cars

Mechanically, the DEMPSTER-DINOSAUR is of extremely simple design. Components are a tipping frame, two hydraulic raise-and-lower cylinders and a double-acting cylinder which controls all container movements. No chains, sheaves or cables are used in its operation. It is the only over-the-road system that can push and pull containers on and off docks or railroad flat cars. This makes it possible to use the DINOSAUR in conjunction with "boxy-back" containerized cargo rail shipments.

The Dinosaur hydraulically pushes a container off on a dock and inside a building for unloading.

Many Sizes and Types of Containers are Available

DEMPSTER-DINOSAUR standard containers come in 21 sizes ranging from 14½ feet to 23½ feet in length and 10 to 41 cu. yd. capacity. Special cargo containers up to 35 feet, tank-type and stake side models are also available. Drop-down telescopic legs to hold container at dock height are optional on some cargo containers.

Free Booklet Offered

A free booklet which describes the operation of this new system in detail is offered by Dempster Brothers, the originator and only manufacturer of DEMPSTER-DUMPSTER Systems.

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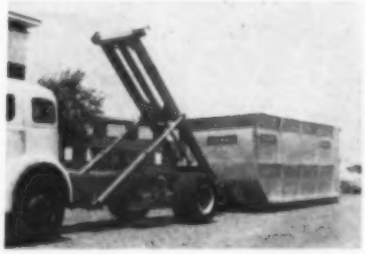
Containerized Cargo, Waste & Raw Materials Handled by DINOSAUR

The newly developed DEMPSTER-DINOSAUR is a system of materials handling that employs giant containers up to 40 cubic yards and larger. It lends itself to any situation where bulk accumulations of raw materials, liquids, waste or finished products must be handled. Since one truck and one driver can automatically pick up, haul and dump or set down a number of containers, the DINOSAUR easily does the work of several trucks.



Dinosaur backs up to loaded container and engages it with lifting bail.

Container is hydraulically pulled up inclined tilting frame.

Container is pulled forward where it automatically locks into carrying position.

The Author

Arthur Herzog ("Read Faster, Read Better") has his Master's degree from Columbia, free-lances for such magazines as *Harper's, Esquire, Cosmopolitan*. Reading is one of his major interests. His speed?—over 1000 words a minute.

relates what happened to himself or someone else. This kind of writing, characteristic of many magazine articles, is not difficult, and the reader is safe to go full speed ahead. Other patterns, such as information imparting, argument and question-and-answer, all make different demands on the reader. By recognizing the pattern he can pace himself and save valuable time.

Learn to Skim

Probably the most accomplished reader is the inveterate skimmer, for skimming involves every major reading ability —the wide glance, the preview, recognition of key words and ideas, organization, resigned willingness to miss, knowledge of literary patterns. Skimmers of the slower variety read by lines, but faster skimmers can descend on a page as if on a straight line down the center, taking in only the words on either side of the line. This reader will not miss anything of importance, either. His knowledge of the written language is such that he can, like a scientist, infer the larger meaning from the facts he has before him. And always, in the back of his mind, is a strong sense of purpose. *This reader knows exactly what he's reading, why he's reading it and how much he must get out of it. He is always thinking hard.*

Once the reader has achieved a good reading speed, he should be wary of "backsliding," keeping his new techniques in mind every time he picks up a book, a report or a magazine. But, if he has been well taught, backsliding should not be a major worry. Studies of students two and three years after they had finished courses at the Institute showed that the majority were actually reading faster than they had at the end of the course.

Results Spectacular

When such reading techniques are taught to adults, the results have been spectacular. The Reading Institute, for instance, gave a reading course in Hollywood in 1956 which was attended by studio executives and top personnel from literary agencies. An actor's agent increased his reading speed from 200 to 800 words per minute and found that his reading time on a standard motion picture script was reduced from 2½ hours to 40 minutes. A producer quadrupled his speed, progressing from 350 words per minute to 1200 words with a comprehension score of 90 to 95 percent. He was able to read an average novel in about an hour.

In the past few years, the Reading Institute has organized an expanded program to provide on-the-spot classes in reading for industries that want them. One of the earliest such ventures, in 1953, was a reading course for a group of 15 proof-machine operators at a bank, whose job was to read and record the numbers on checks. The operators needed not only to recognize numbers more quickly but to increase their speed in locating one number which appeared on different places on the check. To solve this problem, the Reading Institute had 1800 checks reproduced on slides, and operators were taught to read and record them 15 minutes a day for five weeks, a total of 6¼ hours. At the end of that time, the accuracy of the group had increased from 67 to 98 percent, and productivity was up 8 percent. This, of course, was a fairly mechanical application of reading skill, but it showed what adult reading courses can do.

Cuts Home Work

And faster reading may have a place in home life, too. A few months ago, a businessman came to Dr. Smith with the plea that she save his marriage. Every night, he came home with a loaded brief case and, because of the nightwork he had to do, could never go out. Eventually his wife threatened to leave him unless he would share some evenings with her, and so he came to Dr. Smith for a reading course. Today she is pleased to report that the marriage endures. Not psychoanalysis or a fur coat, but 750 words per minute saved this home.

Speed, of course, may not always be wanted. In difficult documents the trick may be to read slowly, looking for the key phrases; and certain works of art, like James Joyce's *Ulysses*, utterly defy the fast approach if the reader wants to get the full benefit of the work. But most written material doesn't require this sort of concentration — in fact, it is better read at a fast clip.

Here's Your Gage

Now then, the way to gage your reading speed is to convert the time into seconds, divide this figure into the total number of words, and multiply the result by 60 to reconvert into words per minute. This article is 2478 words long. At a good reading speed of 700 words per minute, it should have taken you under four minutes, with 95 percent of the ideas remembered. If you failed, you are probably living in a paper jungle.

Several universities, among them New York University, Harvard, the University of Southern California, Denver University, Northwestern and Purdue offer courses in adult reading. Too, there are commercial reading institutes in many large cities. And then, there is self-help. Many readers have helped themselves simply by reading with an alarm clock, timing themselves when it goes off, and then trying to do better next time. Books like Dr. Smith's, which offer scientific techniques, make self-help easier. No matter which way you choose, the way out, says Dr. Smith, is faster!

* * *

TIPS FOR FASTER READING

Preview material —	Check title, subheads, captions, first paragraph, to determine: Worth reading? At what speed?
Don't look back —	Once you've begun to read, press forward. Avoid temptation to go back for points you may have missed.
Watch for main ideas —	Find the one idea in each paragraph. Also, note directional word signals: *such as, also, but, yet,* etc.
Memorize —	As you read, select the facts you want to remember and will yourself to store them away for future use.

HOLLAND: Gas-Servicing a City

Refinery gas is being carried by pipeline to supply Utrecht with fuel . . . Heaters at the Pernis refinery are using heavy fuel oil

A scene in the city of Utrecht, showing the famous Dom Tower.

ONE OF THE BY-PRODUCTS of oil refining is gas — a combination of light hydrocarbons — which is normally used in a refinery to provide heat for the refining process.

In February, 1958, however, the gas produced at the Pernis refinery in Holland was put to another use. It was piped 45 miles to the city of Utrecht where it is today being used for industrial purposes and for cooking and heating in the city of Utrecht, south and a little east of Amsterdam, and in surrounding municipalities.

By arrangement with the Dutch Government, up to 100,000 cubic meters (3,531,500 cu ft) of gas is pumped daily through the pipeline. It takes 24 hours before the gas reaches its destination, which is the gas converter at Utrecht.

In order that this supply could be laid on, the Dutch Government arranged to have a 12-in. pipeline laid between the refinery and the city. The pipeline had to cross 480 canals and ditches and the River Meuse at a point where the river is more than 1600 ft wide.

One of the problems of the contractors who built the pipeline was to lay it so that it would be free from vibration.

In order to supply this gas for domestic purposes, a special purification unit had to be built at the refinery.

Incidentally, since the refinery gas is being put to such a useful service, many of the heaters at the Pernis refinery are now using a heavy fuel oil instead of the refinery-produced gas.

* * *

Reprinted from *Oil* Lifestream of Progress, published by California Texas Oil Company, July, 1958 issue; Richard Haestier, Editor.

C. A. Hofman, manager of the Governmental Gas Supply Company (left) and J. M. Hansen, managing director of Caltex Holland, officiate at the opening of a new service by the Caltex refinery to the city of Utrecht.

C. A. Hofman officiates by turning the valve which starts the flow of gas from the Caltex refinery in Pernis to Utrecht, through a 45-mile pipeline.

Management Personals

▸ **W. W. Clawson** was named a senior vice president of **Magnolia Petroleum Company.** In this new position he will be responsible for all producing operations, including exploration, exploitation, research, and natural gas departments. He has been a director and vice president for Magnolia since December 1957.

Clawson first joined the Magnolia organization in 1933. In 1936 he was named assistant chief geologist and in 1946 chief geologist. In 1953 he became manager of what was then Socony-Vacuum Oil Company's Pegasus Division in Billings, Montana, and president of Socony-Vacuum Exploration Company. In 1955, when Mobil Producing Company was formed to take over operations of the Pegasus Division, he became president of that company also and a year later he was appointed coordinator of domestic production for Socony Mobil Oil Company.

▸ **William Fraser,** formerly with British Petroleum Company, Ltd. was named managing director of **Kuwait Oil Company** to succeed **Sir Philip Southwell** June 1959. Fraser has been appointed assistant managing director until that time. Sir Philip will remain director of Kuwait after his retirement.

▸ **James C. Wishart** was appointed chief accountant for **The Atlantic Refining Company's** crude oil accounting department. He will be headquartered at the firm's Dallas offices. Wishart comes to Atlantic from the New York office of The Texas Company. He was formerly controller of the Seaboard Oil Company until the merger of that firm with The Texas Company in June 1958.

▸ **Harold A. Kirton** was appointed Gulf Coast division manager for the supply division of **Phillips Petroleum Company's** supply and transportation organization. Headquartered in Houston, Kirton will have charge of crude oil purchases and sales and procurement of natural gas liquids for Phillips throughout the Gulf Coast area. Crude oil matters in Houston were formerly handled by **Roy H. Lindsey,** who has retired.

▸ **Clarence D. Shepard** of Ottawa was appointed general counsel of the **British American Oil Company,** with headquarters in Toronto. He was chief commissioner of the board of transport commissioners, and since July of this year has also held the post of acting chairman of the Air Transport Board.

▸ **Dr. Harold D. McBride** and **Dr. Eugene F. Lutz,** research chemists, and **Dr. Philip W. Choquette,** research geologist have joined the **Ohio Oil Company's** research center near Denver.

Dr. McBride's experience includes a research assistantship for the Kettering Foundation and teaching assistantships at Ohio State. Dr. Lutz's included teaching and research assistantships at Kansas State University. Dr. Choquette served a field assistantship and a geologist position with the U. S. Geological Survey in Washington, D. C.

▸ **Ray O. Traylor,** manager of the administrative division in the manufacturing department, **Standard Oil Company (Indiana),** is named to an added position of associate director in the central employee relations department. **Leroy J. Frodin,** assistant manager of the administrative division in the manufacturing department, becomes assistant to the vice president, manufacturing. **John H. Lind,** manager of sales department employee relations, to assistant to the vice president, sales. **R. P. Ivy,** assistant manager, sales employee relations, and **V. M. Clerkin,** sales employee relations adviser, are senior staff assistants in central employee relations.

M. J. Casey, general superintendent for administration and employee relations in the supply & transportation department, becomes senior staff assistant in central employee relations. **B. B. Reed, A. J. King,** and **W. L. Hindman,** employee relations supervisors in the supply & transportation department, named staff assistants in central employee relations.

Patrick J. Colombo was promoted to plans division supervisor in the crude oil coordination department. Colombo replaces **Joseph J. Pope,** who is joining the executive staff of Standard's new affiliate, Amoco Trading Corporation, which is based at New York City.

▸ **William A. Lyon** and **Frank M. Porter** were elected advisory directors of **Chemical Corn Exchange Bank.** Lyon, who is president of Dry Dock Savings Bank, will serve as a member of Chemical's Upper Midtown Advisory Board. Porter, president of the API and also of Fain-Porter Drilling Company, becomes a member of Chemical's Rockefeller Center Advisory Board.

▸ **Gardiner Blackman** was appointed manager of the employee relations department of **Tidewater Oil Company.** He previously was employee relations supervisor of the company's western division. He succeeds **Howard G. Fillhower,** who resigned.

▸ **H. R. Shepherd** of Ponca City, Oklahoma was named assistant manager of **Cities Service Oil Company's** industrial relations division. He was formerly assistant manager at the oil company's Ponca City refinery.

▸ **Jack McMahon** was appointed manager of the advalorem tax division of the **Ohio Oil Company.** He succeeds the late J. W. Elder. He was formerly in the advalorem tax division as assistant manager.

▸ **Ira H. Cram,** senior vice president and chairman of **Continental Oil Company's** executive committee, and **Howard H. Hinson,** vice president in charge of the foreign department, both of Houston, will establish new headquarters at New York City.

▸ **General James H. Doolittle** has retired as a vice president of **Shell Oil Company.** He will continue to serve as a director of the company. General Doolittle became board chairman of Space Technology Laboratories, Inglewood, California. General Doolittle has been with Shell since 1930, when he left active duty with the United States Army Air Corps to become manager of the company's aviation department. He has been a vice president and director since 1946.

R. L. Banker was named supervisor of the engineering section in Shell Oil's general tax department. He was senior tax accountant before his new appointment.

Philip Lipschultz was named to the newly created head office post of manager of commodity-supply and statistics. He was formerly manager of the company's Houston, Texas, purchasing department.

W. F. Reed was named manager of Shell's insurance department. Reed, who was an assistant manager in the insurance department, succeeds **H. N. Englander,** retired after 46 years of service.

▸ **John L. Ivers** was named an assistant vice president, **The First National City Bank of New York.** Ivers is in the bank's petroleum department.

▸ **J. K. Jamieson** of Toronto, was named president of **International Petroleum Company, Ltd.,** which operates in four South American countries. He is planning to resign from his position as vice president and director of Imperial Oil Ltd. to accept the new post. International Petroleum has executive offices in Coral Gables, but its corporate office is in Toronto. Jamieson joined Imperial Oil in 1948 as associate manager of the coordination and economics department, and later went to Sarnia to head the engineering and development division. In his new position he succeeds **M. L. Haider,** who is leaving International Petroleum to become a director of Standard Oil Co. (New Jersey).

▸ **Richard E. Fitch** was appointed financial coordinator for **Continental Oil Company's** foreign operations, with headquarters in New York City.

▸ **Gardiner Blackman** was named manager of the employee relations department of **Tidewater Oil Company.** He previously was employee relations supervisor of the company's western division. He succeeds **Howard G. Fillhower,** who resigned.

▸ **C. Turner Harding,** assistant manager of engineering coordination of **Esso Research and Engineering Company,** was appointed chairman of the Security Committee of Standard Oil Company (New Jersey). He succeeds **Donald L. Ferguson,** who retires March 1.

▸ **Herbert Hoover Jr.** was elected a member of the board of directors of **Monsanto Chemical Company.**

DEATHS

▸ **Howard G. Texter,** 68, wellknown authority on oil country tubular goods, died December 27, at Chapala, Jalisco, Mexico.

▸ **Ralph Crysler McQuire,** 63, manager, Nickel Refining Division, of The International Nickel Company of Canada, Ltd., died at Port Colborne, Ontario, December 23. He suffered a heart attack 2 weeks before.

▸ **Dr. William Reed Veazey,** 75, retired director of The Dow Chemical Company, died December 20 at Youngstown, Ohio.

▸ **Clyde E. Baker,** sales representative for the George E. Failing Company, died December 6, in Denver, Colorado, as the result of a heart attack.

▸ **Joseph F. Adams,** 65, a consultant in the petroleum industry and a pioneer in the field, died December 10 at his home in Wilmington, North Carolina.

▸ **Verne E. Minich,** founder of Wheelabrator Corporation, Mishawaka, Indiana, and honorary chairman of the board, died December 13 in a New York City hospital following an illness of several months.

▸ **Sam E. Brin,** 61, died January 3. He was a founder of Primrose Petroleum Company, National Oil & Grease Company and Hydrotex Industries. He was also vice president of Royal Investment Association.

▸ **Joseph Steele,** 59, purchasing agent of The Buckeye Pipe Line Company, died January 10 in New York City, after a long illness.

▸ **Frank P. Peterson,** 82, died January 13. He was retired assistant manager of production for the old Mid-Continent Petroleum Corporation.

All this and MORE OIL

IN EVERY DROP OF

See on parade—exploration, drilling, production, pipeline, refining equipment and services which make the oil available for use in hundreds of items some of which are shown.

International Petroleum Exposition

MAY 14-23 . . .

1959

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THE CENTENNIAL OF THE PETROLEUM INDUSTRY

Dates of the IPE set in conjunction with World Petroleum Congress to be held in New York a week after the Tulsa Show

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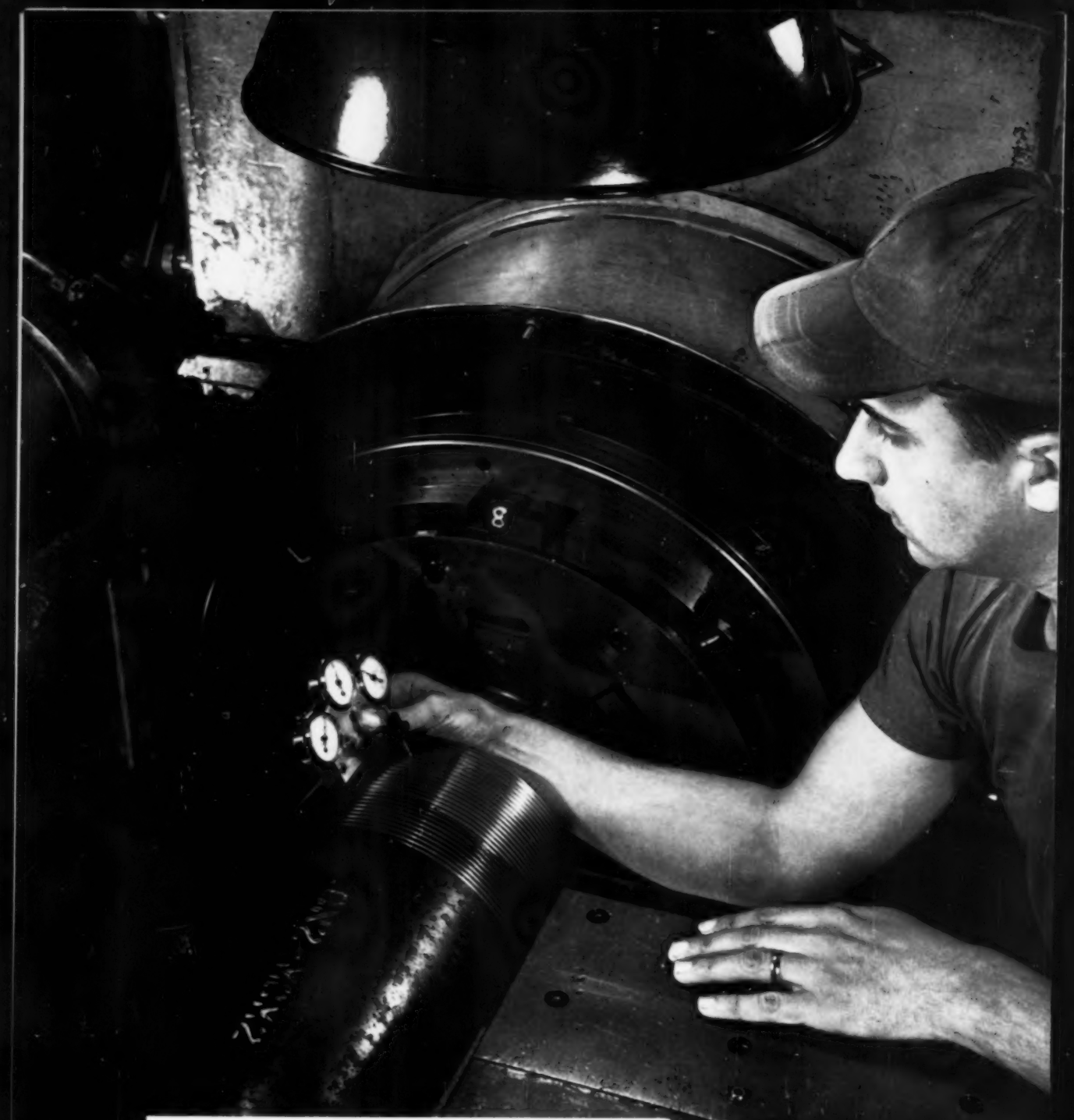
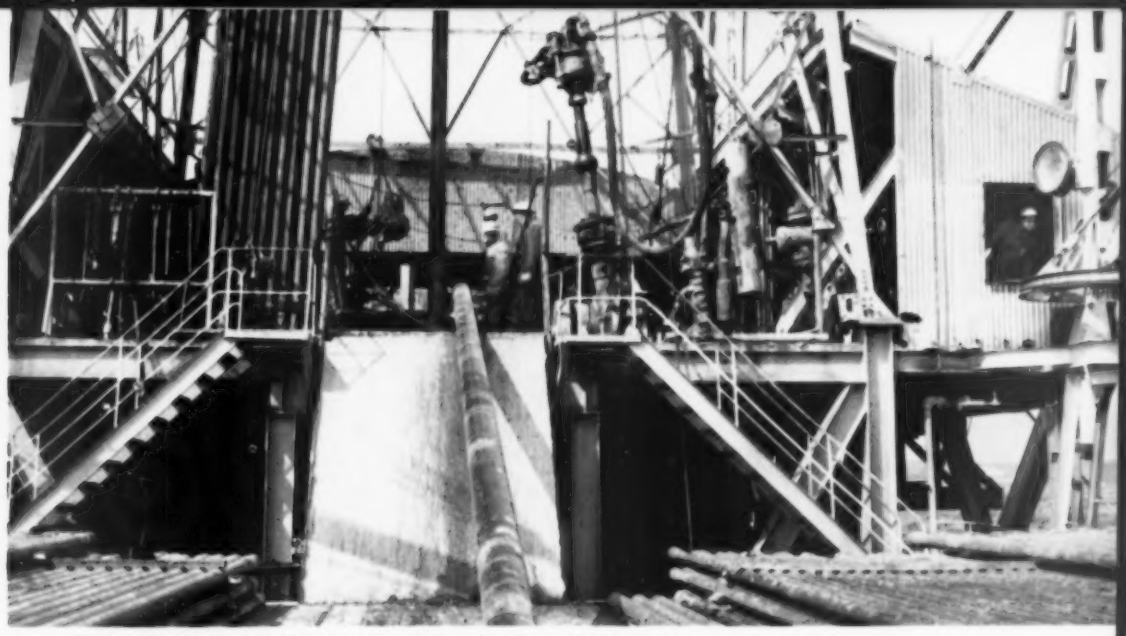


J&L STEEL

"BUTTRESS THREAD" CASING

Operator is inspecting heavy, Acme-type threads of high strength J&L Buttress Thread casing. Coupling threads (five per inch) engage casing threads throughout length of a long coupling. Superior casing is assured through use of controlled-quality J&L steel; automatically controlled heat treatment; precision machining, inspection and testing.



Bell Isle Corporation No. 43 well, located southwest of Morgan City, Louisiana.

"High strength J&L Buttress Thread casing in top sections permits running a longer, heavier intermediate string"

. . . says Sun Oil drilling superintendent

Sun Oil used 5813 feet of Buttress Thread casing in the top sections of the 9⅝" casing in this Bell Isle Corporation No. 43 well near Morgan City, Louisiana.

"The high strength J&L Buttress Thread casing was used so a much longer and heavier intermediate string could be run," according to the drilling superintendent.

"The top 2297 feet of 9⅝" casing was 47 lb. N-80, R-3 J&L Buttress Thread. The next 3516 feet of 9⅝" casing was 43.5 lb. Buttress Thread."

High strength of Buttress Thread is attained by combined effect of completely engaged runout threads and the three-degree flank angle of the thread.

Easy stabbing, rapid spinning and fewer power strokes to pull the coupling up to the power-tight position are provided by the unique thread design.

J&L Buttress Thread casing is available in J-55, N-80, P-110 grades, and in higher grades when required.

Specify Buttress Thread casing for severe and variable drilling operations. Write for information from Jones & Laughlin, 3 Gateway Center, Pittsburgh 30, Pennsylvania.

Top 5813 feet of 9⅝" casing in this new well was high strength J&L Buttress Thread casing. Well was drilled to 14,320 feet by the Sun Oil Company. Diesel Electric Drill Barge No. 2 handled the job.

J&L STEEL

The exciting new J&L

Jones & Laughlin Steel Corporation

PITTSBURGH, PENNSYLVANIA

• News • People — The Trade PARADE

PURCHASE OF ASSOCIATED OIL Field Rentals, oil tool rental company, by Houston Oil Field Material Company, Inc., has been announced. Purchase price was reported as approximately $8,000,000. Associated Oil Field Rentals operates 12 rental yards in servicing centers of oil activity in five states, and maintains an inventory of over 50,000 items of oilfield tools and equipment including more than a million feet of drill pipe rented to the oil industry. The company's gross annual revenue from rentals has averaged some $4.5 million for the past several years. Final details for combining the complementary operations of the two companies have not yet been completed.

Associated Oil & Gas Company will now concentrate its activities exclusively in seeking and producing additional oil and gas reserves.

The rental yards purchased by HOMCO are in Houston, Beaumont, Snyder, Odessa and Alice, Texas; Harvey, Lafayette and Morgan City, Louisiana; Oklahoma City and Duncan, Oklahoma; Hobbs, New Mexico and Casper, Wyoming.

BROHARD & ASSOCIATES, Inc., Dallas advertising and public relations agency, has merged with Ted Workman Advertising, Inc. M. M. Brohard, Jr. becomes vice president and account executive of Ted Workman Advertising, Inc., 8800 Harry Hines Blvd. Brohard will bring his accounts to the Workman shop, and will assume responsibility of account executive on several of Workman's present accounts.

Ted Workman Advertising, Inc. is in its 20th year of business in Dallas.

A NEW DETROIT manufacturers agency, Air Systems, Inc., has been formed by a merger of three Detroit firms. The new organization will market American Air Filter Company's air filter, dust control, heating and ventilating, air conditioning, and engine and compressor products, as well as its Illinois Engineering specialties.

All employees of Saunders & Co., Earl W. Graham and American Air Filter's Detroit branch office will make up the personnel of Air Systems. Al Saunders has been named president of the new firm; Charles Trambauer, vice president; Earl W. Graham, vice president and secretary; and Ken Wagoner, vice president and treasurer. Wagoner formerly was associated with the Trane Company in Detroit.

Air Systems, Inc., will be located at 18263 North McNichols Road, Detroit 19.

ESTABLISHMENT of a European subsidiary by General Controls Company has been announced.

Located in Dusseldorf, West Germany, the new subsidiary General Controls, G.m.b.H, will act initially as General Controls sales and distribution center for Continental Europe. Expansion of these functions to England is planned.

JONES & LAUGHLIN SUPPLY Division, Tulsa, Oklahoma, has announced the completion of a modern store-office building to house their Shreveport, Louisiana district office and store.

The modern building of steel and masonry construction will house the district sales office for the North Louisiana-Arkansas District and the supply store for the Shreveport area. The building is located at 330 Aero Drive in the Agurs Industrial District.

The warehouse section of the building will cover 4800 sq ft of floor area and will include a modern pump shop for servicing bottom hole oil well pumps. A five ton crane will be installed in the warehouse for handling of heavy equipment.

Completion of this store also completes the transfer of all Gardner-Denver mud pump parts to Jones & Laughlin stores, and is now the exclusive distributor for Gardner-Denver mud pump parts. J&L is also distributor in the same area for Gardner-Denver mud pumps.

JOSEPH T. RYERSON & Son, Inc., nation-wide steel distributing subsidiary of Inland Steel Company, has entered Texas for the first time by acquiring the Dallas and Houston plants and stocks of Vinson Steel and Aluminum Company. The transaction was accomplished by an exchange of stock of undisclosed amount.

FOUR SALES FIRMS have been named as new representatives for Solar Aircraft Company's industrial bellows and expansion joints.

They are Control Equipment Company, Inc., The T. J. O'Brien Engineering Company, H. M. Summerell Company, and O'Brien Equipment Company.

Control Equipment Company, Inc., 3240 Peachtree Road, N. E., Atlanta, Georgia, will handle the sale of Solar's industrial products in Alabama, eastern Tennessee and Georgia. The area includes two counties in western South Carolina and excludes the Atlantic coast counties of Georgia.

The T. J. O'Brien Engineering Company, 668 S. Main Street, Memphis, Tennessee, will cover the portion of Tennessee west to the Tennessee River and northern Mississippi.

H. M. Summerell Company, Suite 105 Seaboard Building, Richmond, Virigina, has been assigned to the state of Virigina.

O'Brien Equipment Company, located at 2832 Olive Street, St. Louis, Missouri, will handle the sale of Solar's industrial bellows and expansion joints in eastern Missouri, southern Illinois, and a portion of western Kentucky.

CONTRACT for construction of a $77,000 office building in Claymont, Delaware, has been let by the newly-formed SunOlin Chemical Company. Contractor for the building is Nason & Cullen, Inc., of Philadelphia. Site of the new building is adjacent to Sun Oil Company's Marcus Hook, Pennsylvania, refinery.

When the one-story building is completed about March it will be used initially for construction purposes of SunOlin's proposed urea plant and later to house the administrative and operating staffs of the company. SunOlin Chemical Company was formed this fall as a subsidiary company by Sun Oil Company and Olin Mathieson Chemical Corporation.

ROOTS-CONNERSVILLE BLOWER, Division of Dresser Industries, Inc., Connersville, Indiana, is establishing a new district sales office at 5120 Pacific Boulevard, Los Angeles 58, California.

Manager of the new office will be H. W. Newsome.

Another new office being established is at 3166 Maple Drive, N.E., Atlanta 5, Georgia. Paul E. Johnson will manage the new office.

THE ARIZONA Proving Grounds of Caterpillar Tractor Company, was the site of the Phoenix Sales Conference held for top personnel of Caterpillar dealerships in the United States and Canada. More than 280 representatives from 128 Caterpillar dealerships attended the conference.

The activities at Phoenix were divided between product discussions and Proving Ground sessions. The morning presentations were held at the Hotel Westward Ho, where the attending dealer personnel were given detailed information on the special features and operating capabilities of the machines being demonstrated. Afternoon sessions were held at the Proving Grounds area, where conferees were given operating demonstrations of the units and an explanation and tour of Caterpillar's 8640-acre Arizona research facilities.

▸ **James A. Green** has been appointed sales representative for **Tubular Lining Corporation,** Houston.

HOWE-BAKER has merged with **National Aluminate Corporation.** The general offices and research laboratories have been transferred to Tyler, Texas, and a new office building and laboratory have been built.

THERMOID COMPANY and **H. K. Porter Company, Inc.,** have completed their merger. Outcome is the Thermoid Division of H. K. Porter Company (Delaware).

Porters' new division will manufacture and market all products formerly made by Thermoid Company and Porter's Quaker Rubber Division.

The new Porter Division is headed by Warren E. Hill, former Thermoid president, as vice president and general manager, George Dauphinais as vice president-operations, and the sales organization by J. R. Alexander, vice president-marketing, and E. G. Counselman, general sales manager.

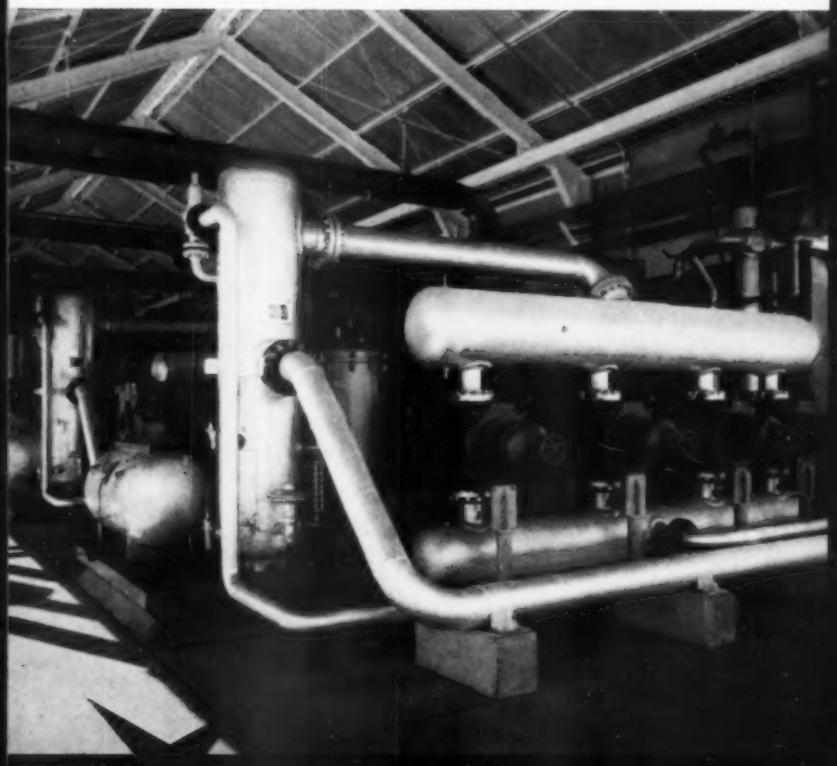
W-K-M, division of ACF Industries, Incorporated, has announced a new policy of appointing independent concerns as authorized repair shops of the W-K-M through conduit gate valves. The first companies appointed are the Barron Machine and Supply, New Iberia, Louisiana, Slim LaGrone Company, Odessa, Texas, and the Blue and Gray Supply, Lafayette, Louisiana.

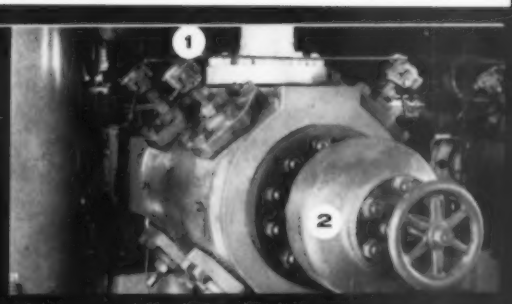
W-K-M authorized repair shops will be required to adhere to the engineering standards set forth by W-K-M, including hydrostatic testing of the repaired valves. Only approved repair parts will be used by these shops, and the repair will be performed using the same techniques as at the factory.

Any "on the line" repair service where the valve is under pressure will continue to be done by W-K-M's own servicemen.

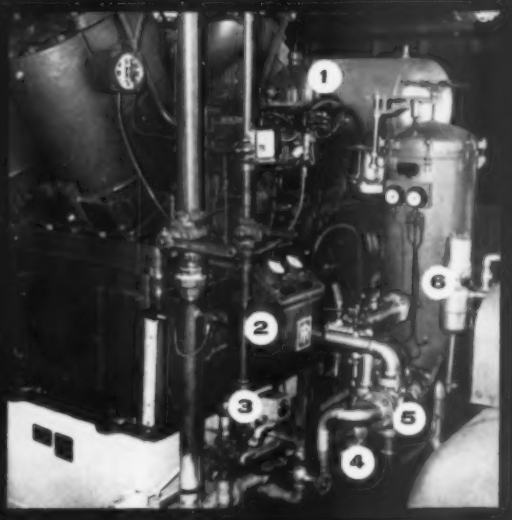
ALCO PRODUCTS, INC., has established a sales agent for the Rocky Mountain region. The MWL Tool & Supply Company with headquarters in Midland, Texas, has been appointed sales agent for ALCO oilfield products. Area to be covered is New Mexico, Colorado, Utah, and Arizona.

TRACERLAB. H. S. Myers, Tracerlab's vice president for marketing, announced that the company will represent Ball Bros. Research Corporation in the sale of their entire line of geophysical and prospecting equipment in foreign countries. Sales will be handled through the company's foreign department with headquarters in Waltham, Massachusetts, and the sales effort will be carried out by Tracerlab's factory and dealer organization comprising 30 dealers who are active in some 35 countries.





COMPRESSOR CYLINDERS have (1) automatic inlet valve unloaders and (2) fixed volume clearance pockets. Valve unloaders are combined with automatic engine speed regulations to provide smooth loading and unloading while maintaining desired pressure conditions.



CONTROL CENTER with (1) AS&P controller (2) Engine gauge panel (3) Crankcase oil level valve (4) Three-way oil temperature control valve (5) Triflo four ported oil valve (6) Scrubber liquid level shutdown switch

4-CYCLE DESIGN

INCREASED FLEXIBILITY FOR UNATTENDED STATIONS

660 H.P. BEAIRD-INGERSOLL-RAND packaged compressors in an automatic, unattended gas boosting station. Units are equipped for unattended operation with speed and pressure regulation. Interstage and after cooling sections are mounted in the Young updraft design radiators. Other Beaird compressors available from 120 to 660 h.p.

Complex or partial control systems will not meet the requirements of a modern, automatically operated unattended compressor station. This is why leading operators select Beaird-Ingersoll-Rand 4-cycle packaged compressor for this service.

The 4-cycle design provides smooth power at any load (even with frequent variations), and at any engine speed from full to half. To meet even greater line variations compressor cylinders can be loaded or unloaded in steps from full to no load. Should conditions require the unit to stand by, the 4-cycle engine can be idled for long periods without carbon build up or damage to the valve ports. This is possible because the constant quality fuel mixing valve will handle all speed and load conditions.

Lowest cost per horsepower to install, Beaird-Ingersoll-Rand packaged compressors require minimum foundation and piping . . . can be easily moved to other service.

Beaird gas engineers are available to assist you with your plans on automatically operated field stations.

THE J. B. BEAIRD COMPANY, INC.
Shreveport, Louisiana
A Subsidiary of American Machine & Foundry Company

CHECK THESE EXCLUSIVE 4-CYCLE FEATURES:

Complete engine speed control
Line pressure maintenance by speed regulation
Gas capacity control by speed regulation
Constant quality fuel mix at all speeds
Long spark plug life
Idling for long periods
Small, accessible air intake piping
One air intake and one exhaust connection
No scavenging air manifolds or piping required

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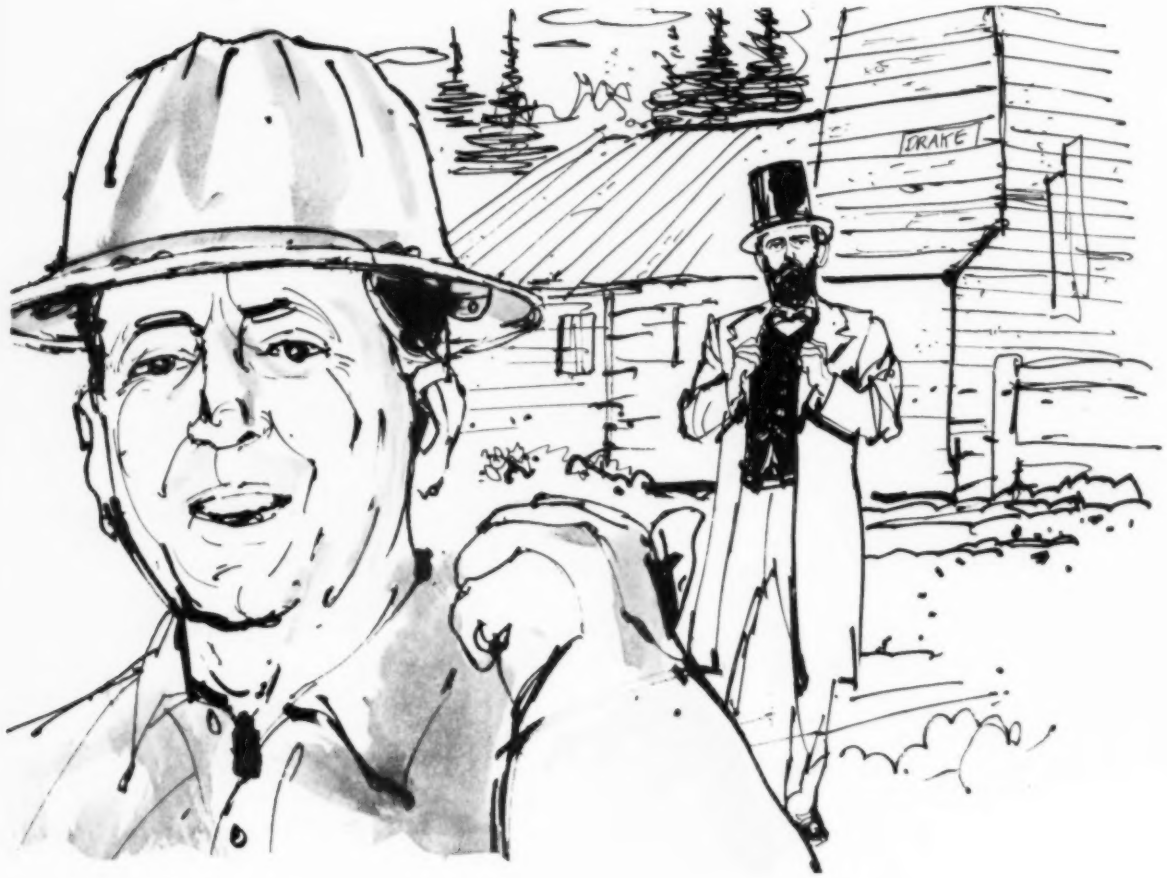
BEAIRD INTERNATIONAL, INC. SHREVEPORT, LOUISIANA • Sales Offices: Calgary, Alberta, Canada • Caracas, Venezuela.



Meet the man who started us in business just one hundred years ago

He's Edwin L. Drake—who drilled the world's first commercial oil well in Titusville, Penn.—August 27, 1859

Your business and mine started when Edwin L. Drake decided to drill rather than dig for oil in Titusville. Some men laughed at Drake, some scoffed and others ignored him completely.

But no man questioned Drake's right to try out a new idea or his freedom to work as he chose. In this unique climate of freedom, America's oil industry was born.

Today, one hundred years later, preservation of the freedom to try new ideas and develop new products to win the favor of our customers remains our greatest challenge. Responsible enterprise is still the very foundation of the oil business...as it has been throughout one hundred years of service to the American people.

Oil's one hundredth anniversary offers every oilman the opportunity of a century to tell his neighbors how his business serves them. This is a proud story and we can be proud to tell it during this Centennial year.

1859 1959

OIL'S FIRST CENTURY
-BORN IN FREEDOM
WORKING FOR PROGRESS

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Center lining of welding-neck and slip-on flanges

ANOTHER FIRST IN THE INDUSTRY-ANOTHER FIRST FROM OTM

A special machine developed, patented and now used exclusively by OTM to center-line each welding-neck and slip-on flange was put into operation on June 1, 1958. Center lining assures correct welding angle through correct matching of bolt holes. Center lining of flanges at the OTM plant, at no extra cost to fabricators, means a greater saving in labor time and production expense!

Again, OTM Blue Ribbon Products, with the most comprehensive written guarantee in the industry, and . . .

OTM FLANGES PROVE THE ECONOMY OF PERFECTION

OTM CORPORATION

P.O. Box 19296 Houston 24, Texas UN 2-6843

Odessa — Dallas — New York — Tulsa — Baton Rouge — Los Angeles

A-4-58

Trade Parade

A GROUP OF TEXAS ENGINEERS widely known in the oil and gas industries will be key executives in charge of a new operation of Southwest Industries, Inc. of Houston.

The Houston firm, organized five years ago to provide specialized services for the natural gas industry, is moving into another industrial field — the design and construction of packaged plants to produce and purify inert gases.

The expansion program, announced jointly by Russell L. Jolley, chairman of the board and president of Southwest Industries, Inc., and Guy W. Cheesman, Jr., vice president and general manager, includes appointment of additional key executive personnel and opening of an office in Calgary, Alberta, Canada.

The new executives, all professional engineers, are E. C. "Ned" Broun, Jr., appointed general sales manager; Carl J. Maki, who was elected president of the Canadian subsidiary, Southwest-Barber, Ltd., and will head the new Canadian office; W. F. Barstow, industrial sales manager, and Charles E. Richards, Jr., sales engineer in charge of small horsepower packaged compressors.

GARRETT OIL TOOLS, INC., a division of U. S. Industries, Inc., has announced the appointment of two new agents to handle the sale of Garrett products.

James S. Kone & Company, 1701 N. E. 4th Street, Amarillo, Texas, will handle Garrett equipment in the Texas Panhandle, Oklahoma Panhandle and Southwestern Kansas.

Hare Equipment Company, 1720 Section Road, Cincinnati, Ohio, is the new agent for Western Ohio, Southern Indiana, and Central Kentucky.

Three new distributors have also been appointed. They are:

Tri-State Industrial Supply Company, with offices in Farmington, New Mexico, will handle all Garrett products in the Four Corners area.

Posey, Inc., of Casper, Wyoming, is the new distributor for all products except relief valves in Wyoming, North Dakota, South Dakota, Montana, and Nebraska, and in those portions of Colorado and Utah outside the Four Corners area.

Frank White Company, of Shreveport, Louisiana, will handle all Garrett products except relief valves in Northern Louisiana, Arkansas, and in the shallow and deep Waskom fields in East Texas.

THE NATIONAL SUPPLY COMPANY has opened an oilfield supply store at Summersville, Green County, Kentucky. The location is in south central Kentucky, about 60 miles southeast of Louisville. Viril L. Cunningham, formerly manager of the company's store at Fairfield, Illinois, has been appointed manager.

The new store will serve Adair, Allen, Barren, Bullitt, Cumberland, Green, Hardin, Hart, Jefferson, Larue, Marion, Metcalfe, Monroe, Nelson, Spencer, Taylor, and Washington counties, extending through central Kentucky from the Indiana to the Tennessee borders.

SOLAR CHICAGO, division of U. S. Industries, Inc., is the new name for Chicago Steel Tank Company, division of U. S. Industries, Inc.

ARMCO ARGENTINA S.A.I.C., Buenos Aires, has been appointed to represent The National Supply Company for the sale of oilfield machinery and equipment and tubular products in Argentina. C. J. Rosker, National Supply's former agent in Argentina, has joined the staff of Armco Argentina.

CONSTRUCTION is to begin immediately on Tube-Kote's new quarter million dollar pipe coating plant near Midland, Texas.

The plant will be built on a 17-acre plot on Tower Road. Construction will cost an estimated $250,000 and should be completed and ready for operation March 15, 1959. The new facilities will have a capacity of coating 10,000 ft of pipe per day. It will employ between 30 and 35 men.

BLAW-KNOX COMPANY, Pittsburgh, has announced that construction of a branch plant for its Power Piping and Sprinkler Division is underway at Jackson, Mississippi. The new facility will expand the company's service in the design, fabrication, and installation of piping systems for the oil, process, electric power and other industries in the South and Southwest. Comprising a building with 17,000 square feet of manufacturing space, the new facility will be constructed on a 15-acre site. Plans are designed to permit ready expansion of this initial facility.

Contracts have been awarded to M. C. Reed Construction Company and Mitchell Engineering Company. Operation of the new branch facility is expected to begin early next year.

FORMATION of the A-Z International Tool Company at Houston for the manufacture of a line of high speed oilfield milling tools by a patented process and other drilling equipment was recently completed and production has been started.

Utilizing "Zitco", an especially developed tungsten carbide cutting material, as a fast and smoothly cutting hard facing material on junk and casing mills of patented design, the company will provide high quality tools and superior service to both the domestic and export markets, according to Jack Cadderdon, company president.

The company is represented by A-Z Export, S.A. in Venezuela and in other export areas by the International Tool and Supply Company, located in New York.

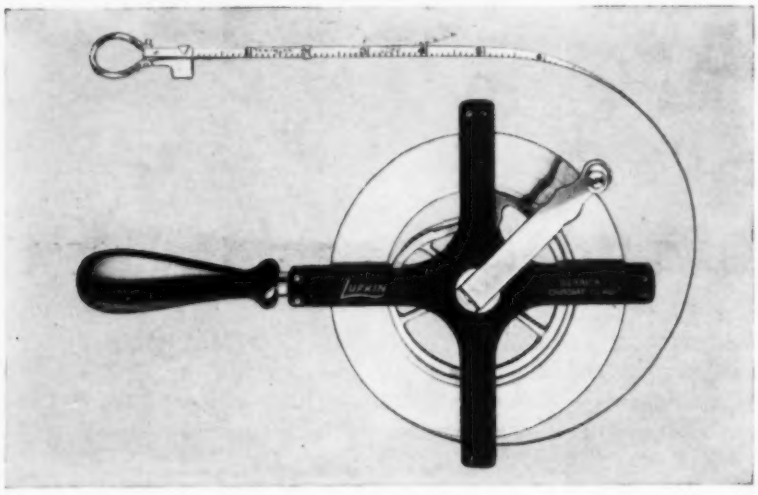
Prior to the formation of A-Z International, Chadderdon was vice president in charge of engineering for Servco of California and later in charge of the Houston operation of Servco. Larry Sanford, vice president, began his oil country work with Magnolia Petroleum Company and later worked as an engineer with Houston Oilfield Material Co. His latest position before joining A-Z International was with Servco as Gulf Coast and Mid-continent Area general manager.

AVONDALE MARINE WAYS, Inc., has been named a franchised applicator of U. S. Permobond tank linings by United States Rubber Company.

Avondale, which operates several plants in the New Orleans area, will be the rubber company's outlet in Louisiana, Alabama, Arkansas and Mississippi as well as the western parts of Tennessee and Florida.

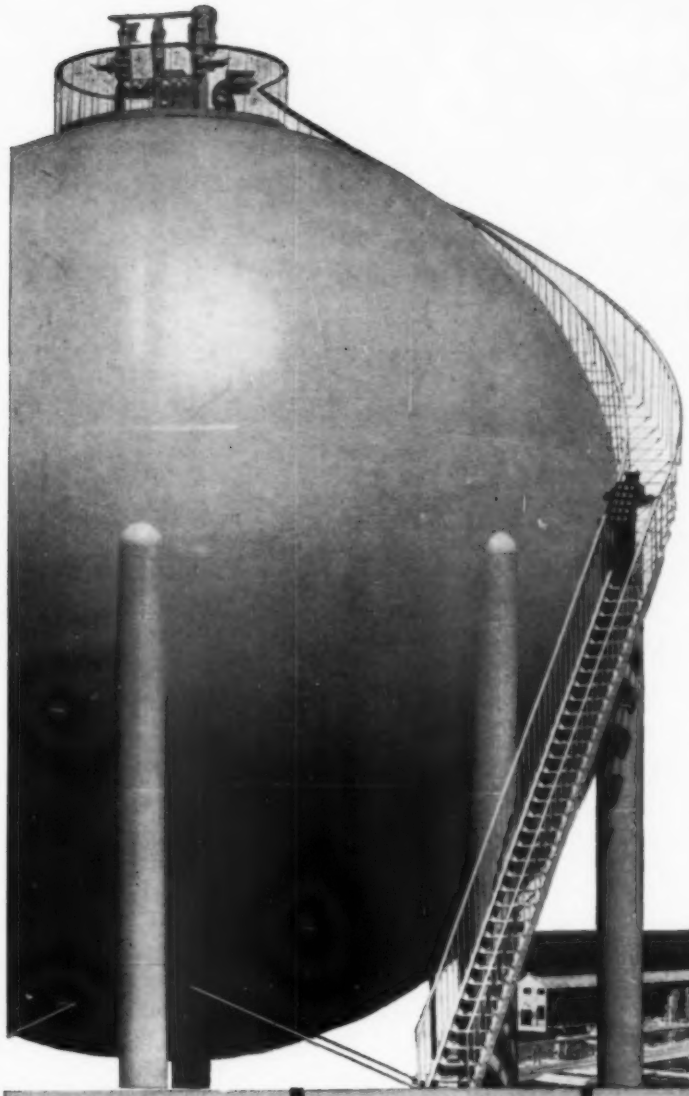
CUMMINS Diesel International Ltd., established to promote the sale and service of Cummins diesel engines in international markets, has been announced.

Cummins Diesel International Ltd. is headquartered in Nassau, The Bahama Islands, with additional offices soon to be opened in Europe and South America. While Cummins Diesel International Ltd. is a wholly-owned subsidiary of Cummins Engine Company, Inc., it will be independently staffed and operated.



Lufkin Chrome Clad® Derrick Tape resists corrosion like no other. Won't rust, chip, crack or peel!

THE LUFKIN RULE COMPANY
TAPES • RULES • PRECISION TOOLS
SAGINAW, MICH. • MIDDLETOWN, N.Y. • BARRIE, ONT.

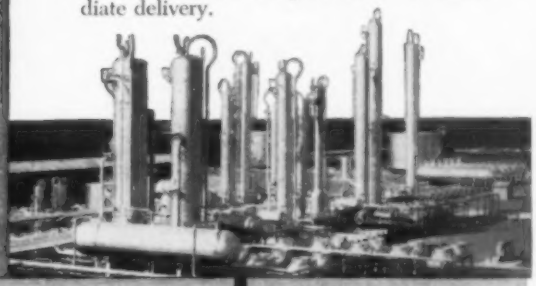


Tough, colorful, lasting beauty!

Take those pumps and rigs in the oil fields—or those tanks and pipelines in the refineries! Each needs the tough, colorful, lasting beauty that Rust-Oleum provides. If the surface is rusty, Rust-Oleum 769 Damp-Proof Red Primer can be applied *right over the sound rusted surface* after removing rust scale and loose rust. Special Rust-Oleum Oil Field Finishes match the original equipment colors on pumps and rigs—while other long-lasting Rust-Oleum coatings protect costly tanks and pipe lines.

They're specially made for oil field use—tough, flexible, easy-to-use on the spot by brush or spray! They dry to firm, glossy finishes that resist sun, fumes, heat, moisture, weathering, and blowing dust and sand.

Try Rust-Oleum . . . your Rust-Oleum Distributor maintains complete stocks for immediate delivery.



Apply Rust-Oleum 769 Damp-Proof Red Primer directly over sound rusted surfaces.

Follow-up with the Rust-Oleum finish coating in the color of your choice

By brush or spray — the Rust-Oleum system provides tough, colorful, lasting beauty.

Dries to a firm finish that resists sun, fumes, heat, weathering, and blowing dust and sand.

RUST-OLEUM®

There is only one Rust-Oleum. Distinctive as your own fingerprint.

STOPS RUST!®

Mail coupon today for FREE TEST SAMPLE

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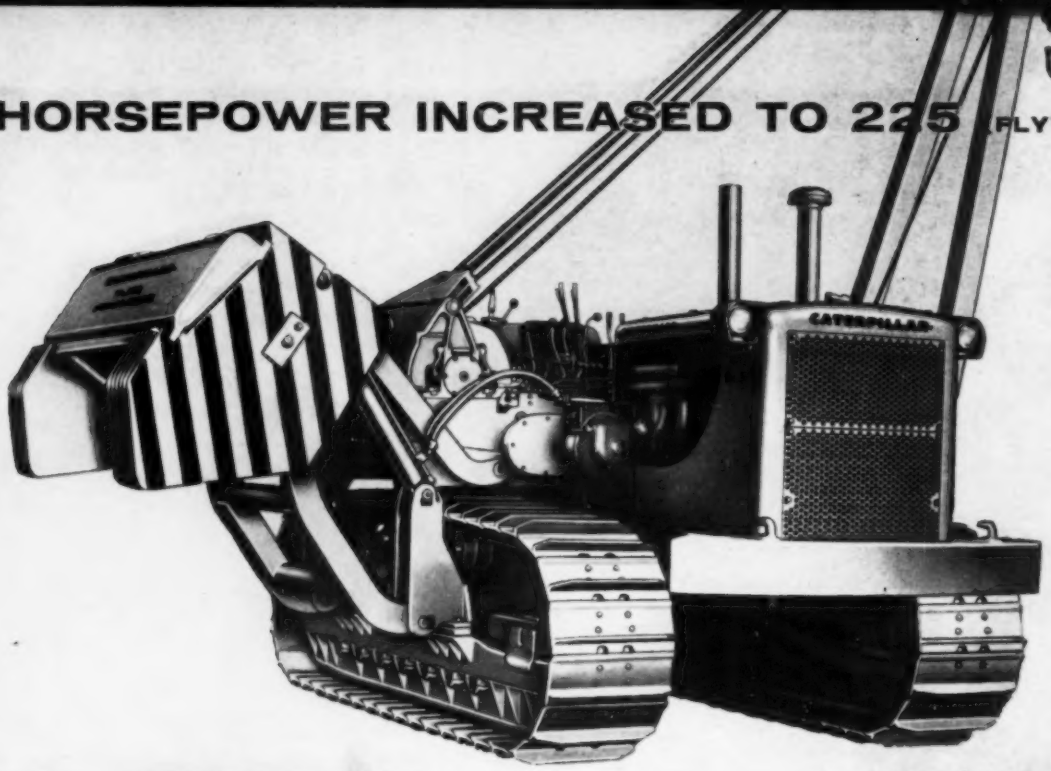
2629 Oakton Street, Evanston, Ill.
Dallas Branch: 3200 McKinney, Dallas, Tex.

- ☐ Free test sample of 769 Damp-Proof Red Primer to be applied directly over sound rusted surfaces.
- ☐ Complete literature with color charts.

HORSEPOWER INCREASED TO 225 (FLYWHEEL)



CATERPILLAR'S
PROJECT PAYDIRT

PROJECT PAYDIRT pays off for you

NEW TURBOCHARGED

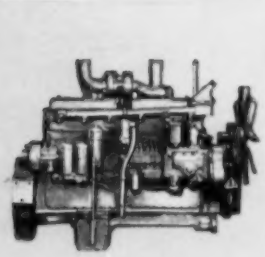
The Caterpillar No. 583 Pipelayer, the standard of spreads around the world, now is bigger, more powerful, more productive than ever. It's another major achievement in Caterpillar's all-out research program, "Project Paydirt" (see box below).

The strongest pipelayer of them all is completely new—in design, appearance and performance. It incorporates dramatic new engineering advances. It is easier to operate.

What will it do on your spread? Here's the answer:

The new No. 583 Series H has a lifting capacity of 137,000 lb.—an increase of 7,000 lb. Its counterweight suspension has been redesigned to make this possible.

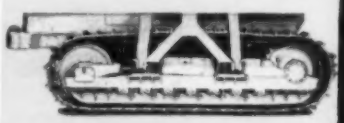
No matter what terrain the pipe takes you through, ground clearance of the No. 583 is well known. Now with it comes greater stability. Tractor gauge has been increased from 86 to 90 inches. Ground contact, with 28-inch shoes, has been increased to 7,220 sq. inches.



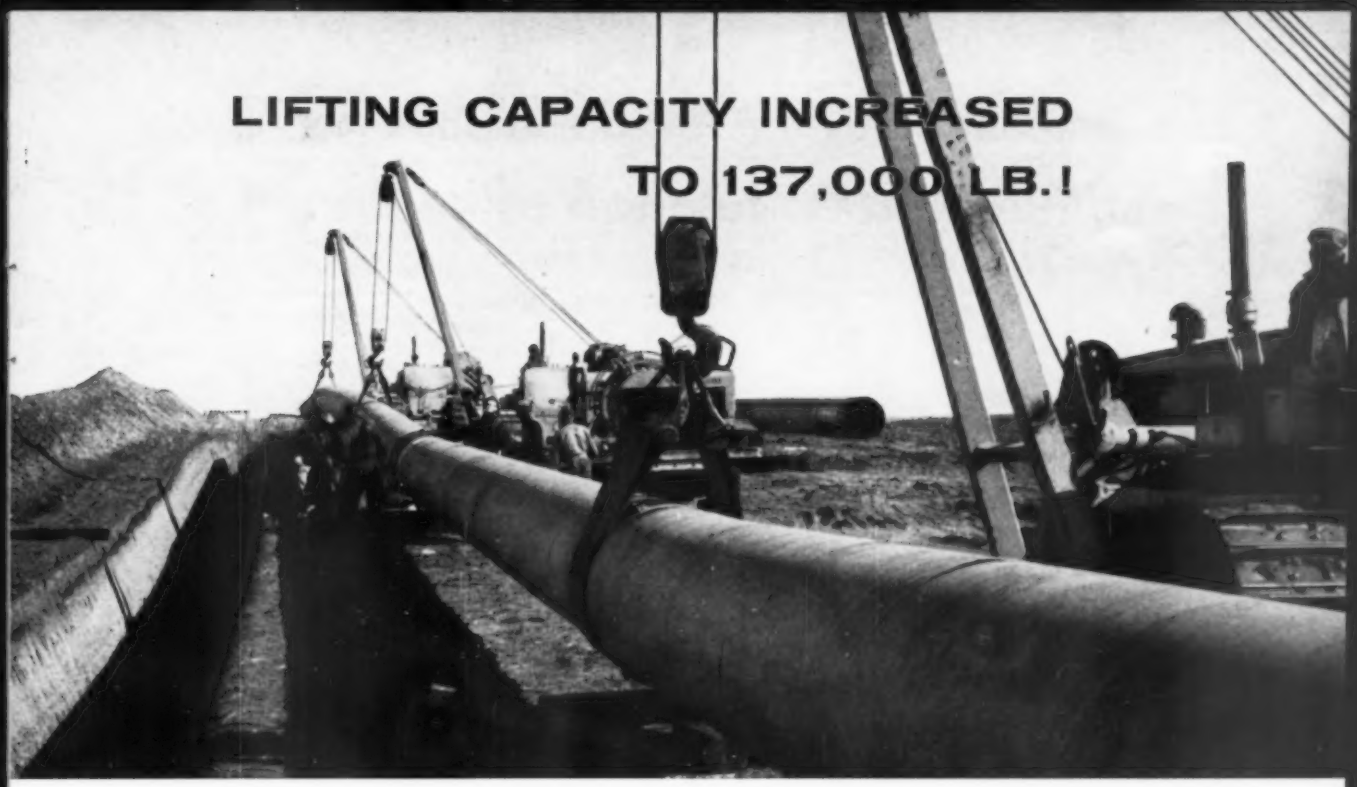
HORSEPOWER INCREASED 18%. The horsepower of the new No. 583 is up from 191 to 225 at the flywheel. In addition, over-all engine performance has been greatly improved by the addition of the efficient job-tested Caterpillar Turbocharger.

SIZE INCREASED. To make effective use of the new horsepower, over-all weight of the pipelayer has been increased 5,800 lb. to a total of 83,800 lb. Increased size means more lifting capacity. Capacity is now 137,000 lb.—an increase of 7,000 lb. In addition, counterweight suspension has been redesigned.

LIFETIME LUBRICATED ROLLERS AND IDLERS. That's right—lifetime! In a major research breakthrough, Caterpillar has achieved track and carrier rollers and idlers that never require further lubrication until rebuilding. And service life is hundreds of hours longer than with ordinary rollers.



NEW, STRONGER, HEAVIER UNDERCARRIAGE. Every component, such as frames, links, braces, pins, bushings, shoes, has been made stronger by the use of improved materials and heat treat processes to provide longer life. And 21 inches of ground clearance – a key feature – has been retained.



NO. 583 SERIES H PIPELAYER

These are only a few improvements on the new No. 583 Series H that will enable you to handle pipe faster. You will get higher production, yet the new machine is actually more economical to own and operate.

Find out for yourself. Get the full story from your Caterpillar Dealer, all the facts and figures that can only be touched on briefly here. Then see this great new machine at work on your spread as soon as possible.

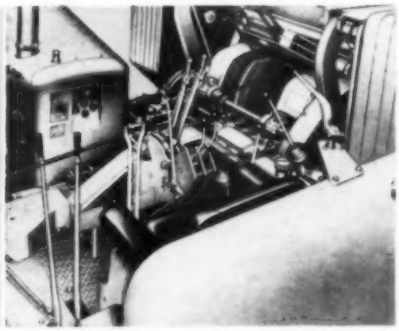
Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

BORN IN RESEARCH... TESTED IN THE FIELD

DRY-TYPE AIR CLEANER. Another major Caterpillar research development on the new No. 583 – the new dry-type cleaner removes 99.8% of dirt in the intake air even under severe operating conditions, means greater engine protection. The new cleaner can be serviced in 5 minutes, costs a good deal less to use.



SUPERIOR OPERATION. Pipelayer controls are conveniently located with "console" mounted levers for the winches. With this new control grouping, it's easy to get accurate cradling while maneuvering the machine. And operator visibility is even better than before because of narrower dash.

MINIMUM SERVICE NEEDS

Here are just a few of the new features that reduce maintenance time:

- Greater cooling capacity.
- Double-reduction final drive to extend life of transmission, bevel gear and pinion, steering clutches and brakes.
- Transmission, steering clutches and brakes get filtered, cooled oil under pressure for longer service life. A Caterpillar exclusive.
- No steering clutch adjustments are necessary.
- Transmission, bevel gear and steering clutches have a common lube system that uses engine oil.

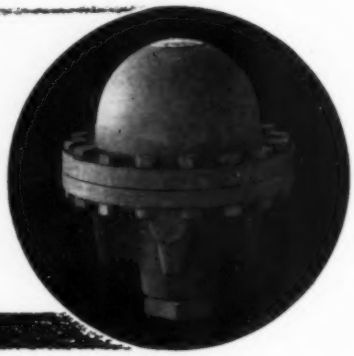
CATERPILLAR'S **PROJECT PAYDIRT**

PROJECT PAYDIRT: Caterpillar's multi-million-dollar research program to meet the coming challenge of the greatest construction era in history with the most productive machines ever developed.

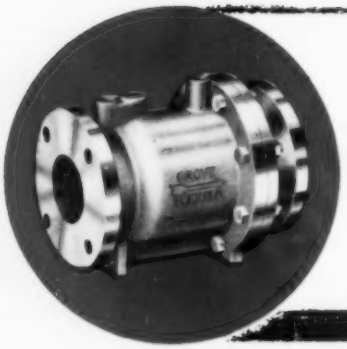
....Demanded by the Petroleum Industry

Designed and Developed by GROVE

From Grove—since 1934—more major advances in the control of air, gas and liquids than any other manufacturer of valves and regulators in the world.



AIR DOME REGULATORS (1934) Revolution in regulator design . . . high resistance to *freezing* . . . instantaneous response over a wide range of pressure differentials . . . chattering and pounding avoided . . . design based on Grove's "Powreactor" air loading principle.



FLEXFLO VALVES (1941) Complete departure from conventional valves . . . exceptional flow and control characteristics yet containing only one moving part —an expansible tube . . . serves as both valve and operating diaphragm . . . ideal for either continuous or emergency action.

SEAL-O-RING GATE VALVES (1953) Designed and engineered to change the habits of an industry. Patented Grove "O" Ring design eliminates lubricants and sealing compounds . . . yet bubble tight closure and absolute ease of operation assured . . . no sticking, wedging or distortion.

GROVE VALVE and REGULATOR COMPANY

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FARMINGTON, N. M. • LAFAYETTE, LA. • HARVEY, LA. • In Western Canada: GROVE VALVE LTD., EDMONTON

5082

VINSON SUPPLY COMPANY, now sharing warehouse and office space with the Vinson Steel and Aluminum Company of Texas in Dallas and Houston, is beginning immediately on plans to construct large new warehouse facilities in those cities. The move is necessitated by the acquisition of the Vinson Steel and Aluminum Company by Joseph T. Ryerson & Son, Inc., a subsidiary of Inland Steel Company, according to Bailie W. Vinson, President. Vinson Steel and Aluminum, once a part of Vinson Supply, was created a separate company five years ago in Dallas, with subsequent expansion to Houston in 1956.

In Houston, Vinson Supply is retaining one-half of the land adjoining the Steel and Aluminum facilities, and will build approximately 70,000 sq ft of warehouse space and 10,000 sq ft of offices. In Dallas a similar move is planned as soon as a site is acquired.

TUBULAR LINING Corporation of Houston, Texas, has appointed Alejandro Fuenmayor Sotillo of Caracas sales representative for Venezuela.

TUBOSCOPE Company International, subsidiary of Tuboscope Company of Houston, Texas, is expanding its services in foreign fields. Bases of operation are being planned in Western Europe, South America and the Far East to service the expanding foreign oil industry. To head this expanding world-wide organization, B. H. Pickard has been elected president of Tuboscope Company International.

ESTABLISHMENT of a marketing research department within the Marketing Division of Consolidated Electrodynamics Corporation and appointment of Richard N. Schuck as director have been announced.

The department will carry out studies which determine the size, location, and characteristics of markets for the company's present and future products. It will also be responsible for sales forecasting, evaluation of sales methods and policies, and general surveys for top management.

Schuck has been a management consultant with McKinsey & Company, Inc., the past 2½ years. Previously, he was manager of marketing research at General Metals Corporation.

WOLVERINE TUBE. Jack H. Smith, manager of field sales, Wolverine Tube, Division of Calumet & Hecla, Inc. has announced major changes in their field sales staff and district organization and the appointment of 4 additional District Sales Managers.

They are **Richard B. Flynn,** formerly east central district sales manager, now sales manager of the Cleveland district. **Carl T. Fuller,** formerly sales manager of the southwestern district, now sales manager of the Chicago district. **Philip MacKay,** formerly sales representative in Philadelphia, now sales manager of the Philadelphia district. **George W. Overstreet,** formerly sales representative in the eastern district, now sales manager of the Dallas district. **Edmund J. Campbell,** formerly sales manager of the midwestern district, now sales manager of the Detroit district. **T. F. Vigmostad,** formerly sales representative in the midwestern district, now sales manager of the St. Louis district. **Richard C. Cash,** formerly sales representative in the southwestern district, now sales manager of the Birmingham district. **Fred F. Moore** will remain as sales manager of the New York district.

YOUNGSTOWN Sheet and Tube Company will expand its tinplate facilities next year to include a second new continuous annealing line for its No. 2 Tin Mill, Indiana Harbor Works, East Chicago, Indiana. Construction is expected to start early next year with completion scheduled for sometime in 1960. Preliminary engineering work is now underway.

THE A. O. SMITH Corporation, Milwaukee, Wisconsin, has formed a new reinforced plastics division with James F. Donnelly, Sr., as general manager. The new division will manufacture reinforced plastic pipe, and other products, which would have a wide application in the oil, chemical, gas, and liquid petroleum gas industries, as well as in other fields having corrosion problems.

APPOINTMENT OF IDECO, Inc., one of the Dresser Industries, Dallas, Texas, as exclusive export sales representative for Walker Well Heads, Inc., has been announced.

No change will be made in the distribution of Walker Well Heads' products in the United States and Canada. Warehouse stocks for the domestic market are carried by supply stores in the major oil-producing centers.

▶ Two changes in the board of directors of **The Dow Chemical Company** have been announced with the retirement from the board of **Dr. E. O. Barstow,** of Midland, and **R. L. Curtis,** of San Francisco. Elected to replace the two retired directors were **Donald K. Ballman,** director of sales, and **C. B. Branch,** manager of the plastics department. Replacing Curtis as Western Division general manager will be **Leland A. Doan,** assistant general manager of the division since 1955.

CLEANING EQUIPMENT

For plant maintenance and tank cleaning, hot "jet stream" cleaning, with Sellers Hydraulic Jets. Send for Bulletin 424-B.

Sellers Injector Corp.
1608-G Hamilton Street, Philadelphia 30, Pa.

CLASSIFIED

WANTED

Drilling Superintendent
Petroleum Engineer

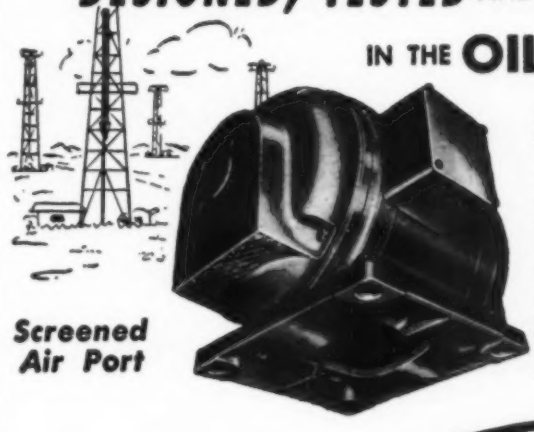
Experienced Drilling Superintendent, who is also fully qualified as a Petroleum Engineer, to supervise one-rig operation in Turkey. Top salary and bonus. Send complete history and references. *Replies confidential.* **Box 205, The Petroleum Engineer.**

PETROLEUM
PRODUCTION ENGINEER

Operations - Administration - Sales

Thirteen years experience in production, drilling and work-overs. Knows equipment, methods and procedures. Ability to plan, coordinate and supervise. Possesses demonstrated sales engineering ability. Desires responsible position in Los Angeles area with progressive producing company, or sales engineering firm. Degree. Age: 39. **Box 206, The Petroleum Engineer.**

DESIGNED, TESTED AND PROVEN IN THE OIL FIELDS



Unexcelled . . . for Outdoor Use

- DRIP PROOF
- VERMIN PROOF
- MOISTURE PROOF
- CORROSION RESISTANT
- FORCED AIR COOLED

All these features of Fieldmaster Ball Bearing Motors have been designed to overcome the rugged conditions of Oil Field requirements.

CHECK THESE OUTSTANDING ADVANTAGES.

Heavy Cast base for alignment, stability, heavy duty, double-shielded, prelubricated bearings, reduces lubrication worries, high grade silicon steel in the magnetic circuit reduces iron losses . . . Wide variety of windings provides triple ratings, dual voltages . . . high torque licks heavy starting problems. High slip is available to take care of reciprocating load requirements encountered in pumping.

FIELDMASTER

Write For Descriptive Literature.

BETHLEHEM SUPPLY CO. TULSA, OKLAHOMA

Manufactured by VALLEY ELECTRIC CORPORATION, St. Louis, 8, Mo.

"An investor is not an exploiter. The modern enlightened political concepts of the free world make economic imperialism impossible. An investment is good only if it is mutually beneficial to the investor and the people of the host country. While the investor expects a return on the investment, the additional capital generated is plowed back into the host country to underwrite the continuation of industrial development."

Eugene Holman, Chairman of the Board, Standard Oil Company (New Jersey)

ESSO

STANDARD OIL COMPANY (NEW JERSEY)

AND AFFILIATED COMPANIES

LADISH

Controlled Quality

LIGHT WEIGHT
WELDING NECK
FORGED FLANGES
125 POUND

TO MARK PROGRESS

Reduce cost... eliminate breakage of cast flanged-end piping components when bolting to steel welding neck flanges

PIPING PROBLEM:

(1) Difficulty experienced in making pressure tight connection with flat face flanges with full face gaskets.

(2) Breakage of relatively brittle cast iron flanged ends on valves, pumps and other piping components when bolted to standard 1/16" raised face steel flanges.

LADISH SOLUTION:

The 125 pound Light Weight flange developed by Ladish is an ideal solution to this problem . . . for not only does it solve the problem . . . but it provides significant additional advantages of cutting purchase costs and reducing weight.

You can depend on Ladish for leadership in introducing piping developments to reduce cost and improve service.

A national network of distributors, Ladish plants and sales offices is ready to serve you.

Specification sheets on Light Weight Flanges and Welding Fittings available on request.

POSITIVE, LEAK-TIGHT JOINTS

Proven design principle of raised face flange has been adapted to assure a completely safe, positive connection to class 125 cast iron flat face flanges.

ELIMINATES NEED FOR HEAVY FLANGED ENDS ON VALVES AND PUMPS

No longer is it necessary to pay a premium to obtain the heavier flanged end valves, pumps and other piping components required to withstand bolting to raised face steel flanges in a welded piping system.

LOW WEIGHT—AMPLE STRENGTH

Light cross section design reduces weight to 30-50 per cent of ASA 150 pound Welding Neck Flange . . . still possesses ample strength to assure safe, leak-tight joint with mating cast flange.

LOWER COST

Savings in purchase price of Light Weight flanges are supplemented by additional savings realized by selecting valves on the basis of pressure rather than strength characteristic of flanged ends.

EASE OF INSTALLATION

Adequate welding neck type hub length keeps welding heats safely from flange. Prevents unpredictable warpage and deformation. Light weight facilitates handling, speeds positioning and installation.

MINIMIZES PIPEFITTER PRECAUTIONS

Safe and suitable for use with either carbon or alloy steel bolting . . . either full face or ring gaskets, in 1/16" or 1/8" thicknesses.

PRESSURE-TEMPERATURE RATING

Rating corresponds to ASA B16.1 class 125 cast iron flanges . . . 125 PSI (gauge) saturated steam; 175 PSI (gauge) water, oil or gas at 150° F.

SERVICE APPLICATIONS

Widely accepted for low pressure piping in gas distribution service . . . utility services such as water, heating, air conditioning, refrigeration . . . pumps and compressors.

TO MARK PROGRESS

LADISH CO.

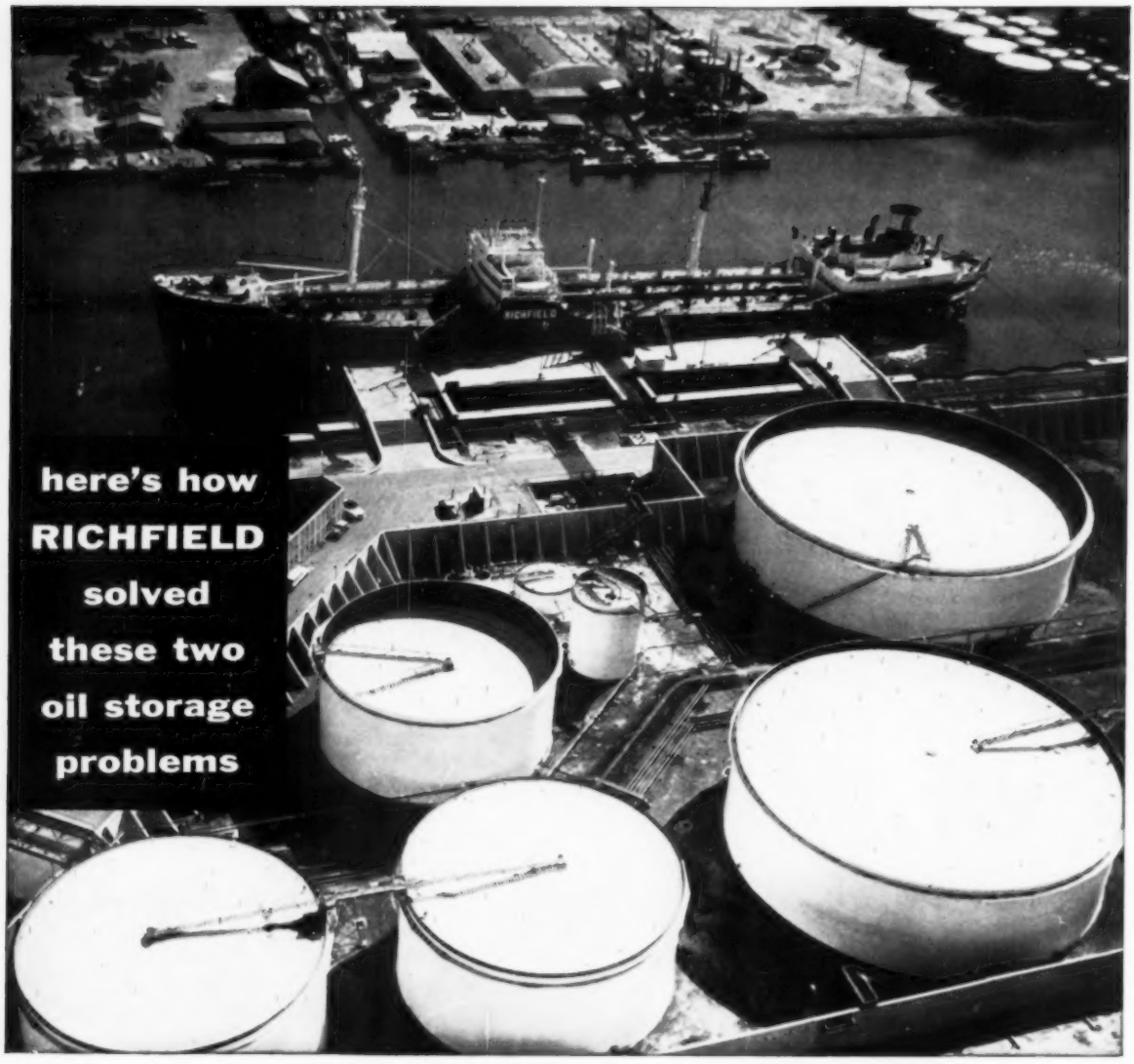
CUDAHY (Milwaukee Suburb) WISCONSIN

SALES OFFICES: Amarillo • Atlanta • Baton Rouge • Buffalo • Calgary
Chicago • Cincinnati • Cleveland • Denver • Havana • Houston • Los Angeles
Mexico City • Montreal • New York • Odessa • Philadelphia • Pittsburgh
St. Louis • St. Paul • San Diego • San Francisco • Seattle • Toronto • Tulsa

SAW BLADES • PIPE FITTINGS • DROP FORGINGS • RINGS • VALVES

LADISH... THE FITTINGS LINE THAT OFFERS COMPLETE SERVICE IN TYPES, SIZES AND MATERIAL SPECIFICATIONS

WELDING FITTINGS	ASA & MSS FLANGES	SCREWED & SOCKET FITTINGS & UNIONS	LONG NECKS	LARGE DIAMETER & T.E.M.A. FLANGES



1. Fire Hazard 2. Vapor Loss

Here is an investment by Richfield Oil Company that pays off in safety and conservation. It is a seven-tank addition to Richfield's Marine Terminals that adds half a million barrels capacity. The tanks, built by General American, are equipped with Wiggins Floating Roofs with Wiggins Safety Seal that stops vapor loss and protects from rim fires.

Wiggins Double-Deck Floating Roofs with the Wiggins Safety Seal, reduce vapor space under the circumferential fabric to an absolute minimum. This practically eliminates losses due to thermal breathing and serves to prevent rim fires. The fabric is of a new, long-lived type and a special weather-hood protects it from the sun. The seal mechanism is always out of the liquid and the corrosive vapor space. Only the Wiggins Safety Seal gives you all these advantages.

PLATE & WELDING DIVISION
GENERAL AMERICAN
TRADE MARK

PLATE & WELDING DIVISION
GENERAL AMERICAN TRANSPORTATION CORPORATION
135 South LaSalle Street, Chicago 90, Illinois
Offices in all principal cities

It pays to plan with General American

FOR FURTHER INFORMATION ON
ADVERTISED PRODUCTS, SEE READER SERVICE CARD

▸ **W. W. Hicks** has been appointed an FWD truck dealer by the **Four Wheel Drive Auto Company,** Clintonville, Wisconsin.

▸ **Sidney A. Lewis** has been appointed manager of technical sales service of the **Walworth Company.** He will be responsible for the activities of the technical sales service group, and will also be manager of bronze valves sales.

▸ Promotion of **B. J. (Bill) Bucy** to division engineer of **The Western Company's** Oklahoma City division has been announced. He formerly was electronics and explosives engineer at Western's Midland research facilities.

▸ **R. B. Bender** of Fort Worth is president of the newly-formed **Tejas Plastics Material Supply Company.** The new company will specialize in manufacturing and distribution of plastics used in prevention of corrosion of underground pipes and fittings.

▸ **C. H. Dresser, Jr.** has recently been employed as city salesman for **Milwhite Mud Sales Company** in Houston, Texas. Before joining Milwhite, he was with the Cameron Oil Company on the West Coast and the Pan American Oil Company in Oklahoma Ctiy and Houston in their land departments.

▸ **J. R. Connell** has been appointed acting purchasing agent of **The Babcock & Wilcox Company's** boiler division. He succeeds **W. C. Moulder,** who has been named to the staff of P. H. Setzler, vice president of the division's manufacturing department.

▸ **Carl Brown** has been transferred from Los Angeles to Denver, Colorado, where he will set up new headquarters for **Kobe, Incorporated's** Rocky Mountain sales division. **Ralph Fanthus,** district sales manager, has been moved from Bakersfield to Los Angeles and will have charge of California sales activity. **William C. Prigge** has been named western district sales representative for **Kobe's** industrial sales.

▸ **Mercer Brugler** was elected chairman of the board of **Pfaudler Permutit Inc.** and **Donald A. Gaudion** was elected president of the company. Brugler was continued as chairman of the executive committee, a position he has held for a number of years. The board of directors also approved the appointment of **C. Wendell Beck** as general manager of the Pfaudler Division, succeeding Gaudion who has been acting in that capacity. **H. W. Foulds,** former chairman of the board, retired in January but is retaining membership on the board.

▸ **Robert L. Cahill** has been named production engineer to head-up the production engineering department of **The Vapor Recovery Systems Company,** Compton, California. **Ray V. Long** has been promoted from district sales manager to vice president and sales manager.

▸ **Tom S. Moughon,** formerly manager of the South Louisiana district for Unit Rig Company, Inc., has been appointed project engineer by **The Brewster Company,** Shreveport, Louisiana, manufacturer of oil-field drilling equipment.

▸ Five top executives of the **Reed Roller Bit Company—J. A. Grundy, Wiley B. Noble, G. J. Gilbert, R. G. Stockton,** and **T. B. Ellis** — have been given new appointments in the company's expansion in production, engineering and sales.

Grundy, formerly vice president, manufacturing, has been appointed operating vice president. He will direct all Reed operations exclusive of sales and finance.

Vice President Noble, formerly head of engineering is now in a new executive liaison post. He will carry out sales/engineering liaison activity between Reed's general and sales management and Reed licensees and customers.

G. J. Gilbert has been appointed chief engineer. Formerly, he was assistant chief engineer.

Stockton, formerly purchasing agent, is now materials manager, in which position he will be responsible for purchasing, production control, material control, stores and shipping in the Reed plant in Houston.

Former Chief Industrial Engineer T. B. Ellis has been promoted to the position of factory manager. In his new capacity, he will be in charge of industrial engineering, manufacturing engineering, and the production facilities at the Reed plant.

▸ **F. E. "Bake" Sandefer** has been promoted from area service manager to division manager of the Four Corners Division for **Homco.** He will have charge of both sales and services, with headquarters at Farmington, New Mexico. His assistant will be **Jack E. Lindell.**

▸ **E. H. (Ed) Murphy,** Dallas, a veteran with 20 years' experience in pipeline construction, has been appointed special representative to the pipeline industry by **Gardner-Denver Company.**

Murphy's headquarters will remain in Dallas, but his activities will be coordinated from the firm's headquarters in Quincy, Illinois.

▸ **Bryan Sweetwater** has been added to the staff of **Jetwell, Inc.,** Tulsa wireline servicing company specializing in perforating and logging. Sweetwater will be stationed at Cushing as district sales engineer for the firm.

H-O-H*

GLUCOSATES*

Improved Through Research
Proven By Performance
The Best For Your
Water Treating Problems

WE READ WATER* H-O-H ESTABLISHED 1931

Write for literature on your letterhead.

*REG. U.S. PAT. OFF.

D.W. HAERING & CO., INC.
ANALYSTS · CONSULTANTS · MANUFACTURERS
P. O. Box 10337
San Antonio 21, Texas

Trade Parade

M. W. "Ozzie" Osborne, general sales engineer for **Dowell,** has moved from Fort Worth to augment the staff in Dallas.

K. R. Chandler has been promoted from assistant sales manager to the newly created post of assistant vice president of sales for **Koehring Division** of Koehring Company. Also announced is the appointment of **William B. Dickerson** as sales manager.

Charles K. Fennel has joined **Texas Instruments Incorporated** as manager of marketing techniques.

Harvey D. Lowe has been elected vice president of **BrakeSol, Inc.,** Oklahoma City. He has been general manager of the firm since 1950. Other changes are: **Pat Curtin,** Oklahoma City and **Bill Ramsey,** Pratt, Kansas, have been promoted to division treating engineers. Treating engineers recently added to the BrakeSol staff include **Harry Morgensen,** Oklahoma City; **Bob Campbell,** Healdton, formerly with Oil Well Supply; **Preston Hanks,** Midland, Texas, formerly with Aguaness and **Ray Petete,** Pratt, Kansas formerly with Oil Well Supply.

Hugh Q. Buck of Houston, general counsel of **Houston Oil Field Material Company, Inc.,** (HOMCO) for 17 years and well known in the oil industry has been named acting president of the company. George O'Leary, founder of the 30-year-old oil field supply and service firm and president, died suddenly December 12.

Buck, who is partner in the Houston Law Firm of Fulbright, Crooker, Freeman, Bates and Jaworski will continue as a partner and serve as acting president until a new president is appointed.

John L. Tullis has been elevated to president and general manager of **The J. B. Beaird Company, Inc.,** manufacturer of heavy steel products and a subsidiary of American Machine & Foundry Company. Tullis, who has been executive vice president, succeeds **J. Pat Beaird,** son of the company's founder and president since 1939, who has resigned. Beaird will remain as a director of the Beaird Company and a member of the board of directors of American Machine & Foundry Company.

Tullis will also head Beaird International, Inc., and the Phoenix Corporation. He entered the company in 1947 as general manager of sales and was advanced to vice president of sales in 1954. In July, 1957, he was appointed executive vice president of the company and a member of its board of directors.

Haskell "Inky" Wotkyns has been appointed special representative for the **American Iron & Machine Works Co., Inc.,** Oklahoma City.

Victor J. Elliott has been named sales engineer for the Newark, New Jersey, territory of the recently expanded **Technical Products Division,** Mine Safety Appliances Company, Pittsburgh.

R. H. (Dick) Wilson has been appointed assistant manager of the foundry division of **American Hoist and Derrick Company** of St. Paul, Minnesota.

William O. Blandford has been named assistant to the merchandising manager of **The Dayton Rubber Company's** mechanical goods division.

V. C. Horner, formerly vice president and sales manager for Byron Jackson Tools, Inc., has been appointed vice president and general manager of **BJ Electronics** (Santa Ana, California).

Peter W. Cooke, recently appointed manager of the newly created **Magcobar Division of Dresser** (Great Britain) Ltd., will be responsible for that company's activities in Europe and the Middle East. He will make his headquarters in Dresser's offices at 197 Knightsbridge, London, England.

Francis W. Winn, formerly technical director of Fractionation Research, Inc., Alhambra, California, has joined **Fritz W. Glitsch & Sons, Inc.,** Dallas, as director of research and development for fractionation trays.

William T. Crawford has resigned as chairman of the board of **Stone & Webster, Inc.** He will continue as a director.

Whitney Stone, formerly president, was elected chairman of the board and chief executive officer, and **Richard N. Benjamin** was elected president and a director; he had been president of Stone & Webster Service Corporation.

At a meeting of the board of Stone & Webster Service Corporation, Benjamin was elected chairman of the board of the Service Corporation and **Peter J. Rempe,** who had been senior vice president, was elected president.

The Youngstown Sheet and Tube Company has elected four new vice presidents. They are: **Robert P. Bremner,** vice president, raw materials; **Donald S. Day,** vice president, traffic; **Dr. Karl L. Fetters,** vice president, research and development; **James D. Sloan,** vice president, purchasing.

Appointment of **Edward Sullivan** and **Henry John Reed** as project engineers for the **Barrett Division of Allied Chemical Corporation** has been announced.

Houston Hospitality at its Best!

When business or pleasure brings you to **Houston,** enjoy the superlative comforts and conveniences of the **NEW Rice Hotel** — ideally located in the heart of the downtown section. Enlarged, remodeled, and beautifully redecorated from top to bottom, The **Rice** is now truly **"Houston Hospitality at its best."**

★ *Home of the* **PETROLEUM CLUB** ★

The Rice Hotel
HOUSTON, TEXAS

PROTECT & SEAL THREADED FITTINGS

Apply **LED-PLATE** Sealing & Anti-Seize Compound

Recommended for HYDRAULIC FITTINGS
will not plug orifices

FAST ASSEMBLY
No cross threads
Tight with less torque
Lead is a thread tube.

A REAL PIPE SEALER
Pressure held 20,000 psi up Liquid or Gas

U.L. approved for butane, propane, gasoline, petroleum.

Use for: Hydraulic fluids, steam, ammonia, etc.

NO HEAT FREEZE
Temperature range—100° to 2987° F.

NO CORROSION WELD
Stops rusting, acid-etch and corrosion.

NO GALLING OR SEIZING
Recommended for aluminum, stainless, titanium, plastic, steel, brass, etc.

EASY DISASSEMBLY ANYTIME
Better than new threads.

— for
STUDS, BOLTS, GASKETS
AIRCRAFT PLUMBING
AUTOS MARINE
OIL WELLS PIPING

(No. 250)

Stocked by Supply and Hardware Stores

Ask for FREE SAMPLE

ARMITE LABORATORIES
6609 Broad Street Los Angeles 1, Calif.

So many ways the ***FISHER/MAN***
can give you a helping hand with the

WIZARD II
PRESSURE CONTROLLERS

- Two Position Controller
- Proportional Controller
- Proportional Controller —Remote Set
- Differential Proportional Controller
- Pressure Transmitter
- Differential Proportional Controller— Remote Set
- Proportional Reset Controller
- Differential Proportional Reset

This "Jack of ALL Trades" is surprisingly low in cost

The partial list of applications at left tells you why the Wizard II is so aptly named. Probably no other controller in the Fisher line is as versatile. Available in brass, steel or stainless steel Bourdon tubes for ranges from 25 to 10,000 psi. Brass or stainless steel bellows available for low pressure service from 30″ Hg Vacuum to 30 psi.

Fisher has carefully designed each component of the new Wizard to satisfy the most rigid process control requirements. A completely descriptive and illustrated booklet on the Wizard II is yours for the asking. Write for Bulletin D 4150 A.

IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD . . . CHANCES ARE IT'S CONTROLLED BY . . .

FISHER GOVERNOR COMPANY

Marshalltown, Iowa / Woodstock, Ontario / London, England

CONTINENTAL EQUIPMENT CO. DIVISION, Coraopolis, Pennsylvania

FISHER® Controls

SINCE 1880

SEE FOR YOURSELF HOW

OSPHO®

PREPARES RUSTED METAL FOR PAINTING...

Send for FREE Test Sample

Eliminate sand-blasting or flame-cleaning. Simply brush off loose rust and apply OSPHO on the rusted metal surface. One application *kills* the rust and provides a *sound* base for your regular maintenance paint. Rust action is stopped — paint jobs last much longer.

OSPHO is *not* a primer — *not* a paint. It is a carefully balanced phosphate chromate metal treatment which chemically changes rust (iron oxide) into iron phosphate — an inert, hard, gray surface ideal for painting.

OSPHO provides excellent coverage . . . a gallon treats up to 600 square feet. And cost is low. Available in 1-gallon containers (in cases of 4), 5-gallon pails, 50-gallon barrels. Colorless, non-toxic, non-flammable. Available through distributors.

Repeat orders over the past 16 years are proof of OSPHO's effectiveness. *See for yourself . . .*

Write Now For FREE Test Sample
(on company letterhead)
and descriptive literature

TREATS NEW METAL TOO!

When applied on new ferrous metal, galvanized iron and aluminum, OSPHO imparts a slight etch to the metal, insuring tight bond of the paint coat that follows.

ONLY OSPHO KILLS THE RUST

RUSTICIDE PRODUCTS COMPANY
3125 Perkins Avenue • Cleveland 14, Ohio

QUALITY MAINTENANCE PRODUCTS SINCE 1917

Laugh with Barney

A young London girl who was holidaying in the country became rather friendly with a young farmer. One evening as they were strolling in the fields they happened across a cow and a calf rubbing noses in the accepted bovine fashion.

"Ah," said the young farmer, "that makes me want to do the same."

"Well, go ahead," said the girl, encouragingly, "it's your cow."

Here's a sure sign of old age, when the gleam in your eye is from the sun hitting your bifocals.

Maybe one swallow doesn't make a summer, but it sure breaks a New Year's resolution.

ENTIRELY CRAZY

A professor wanted to give a rather difficult question in logic one day, so he asked this question: "The United States is bounded on the north by Canada, on the south by the Gulf of Mexico, on the east by the Atlantic Ocean, and on the west by the Pacific Ocean; how old am I?"

After a moment one of the students held up his hand, and the professor called on him and asked the answer. The student said, "Well, you're forty-four." "Why," said the professor, "that's right. How did you reason that out so quickly?" The student said, "Well, I have a cousin at home who is twenty-two, and he's only half crazy."

The young bride's mother had some old-fashioned ideas of marriage and passed them on to her daughter. "Never let your husband see you in the nude," she advised. "You should always wear something."

Two weeks after the wedding the girl and her brand-new husband were preparing to retire when the fellow asked, "Dear, has there ever been any insanity in your family?"

"Not that I know of," she answered. "Why?"

"Well," said her husband, "we've been married two weeks now and every night you've worn that silly hat to bed."

Mother: "Now, Willie, I want you to get acquainted with the new nurse. Go in and kiss her nicely."

Willie: "Yes, and get my face slapped like papa did?"

"Stop! Please don't do that, dear. Stop! Do you hear me? Stop!"

"What do you think you're doing, writing a telegram?"

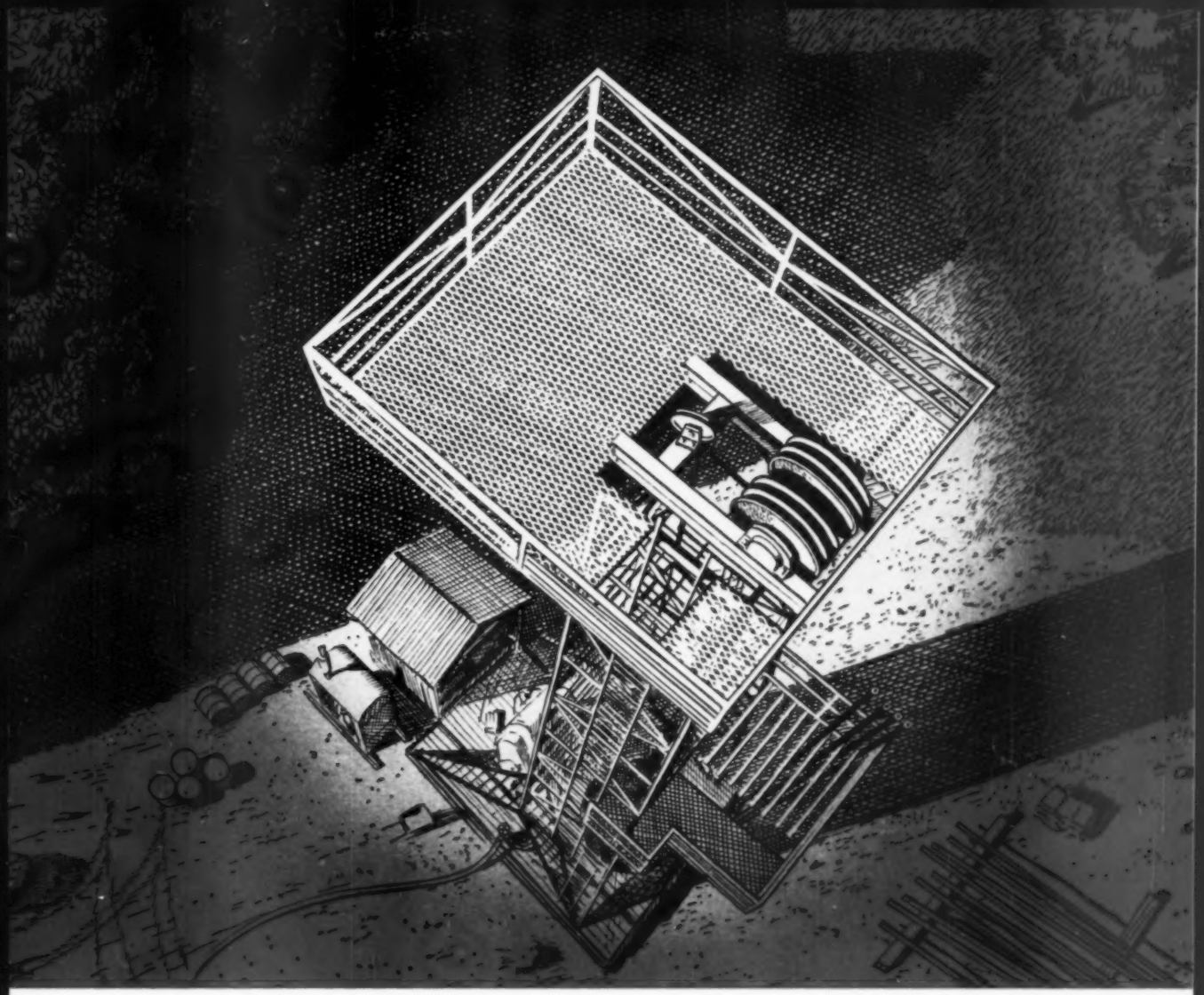
Mother: "When I was your age, young lady, a nice girl would never think of holding a young man's hand."

Daughter: "But, mother, nowadays a nice girl has to hold a young man's hand."

Girls are like cigarettes
A fact you must admit;
You can't enjoy them properly
Until you get them lit.

By the time you have money to burn, the fire has gone out.

Sex is like business — when its good, its wonderful; when it's bad it's still pretty darn good.



RIGHT...from the top down

A good, dependable water supply system is no better than its beginning. The best beginning is a Layne drilled water well. Layne is the largest water well drilling organization in the world with over 75 years experience. Trained crews operate over 500 drilling and service rigs throughout the country.

Layne service doesn't stop there. A dependable Layne Pump specially designed for the job to deliver a specified QUANTITY of water, and Layne water treatment service to supply the exact QUALITY of water desired, are part of a complete job with undivided responsibility. But, that's not all. Layne maintenance and repair service wraps up the complete package. Your nearby Layne Company is as close as your telephone, so, call on Layne for a dependable water supply, right . . . from the top down, all backed by Layne Research.

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Offices and Factory, Memphis 8, Tenn.
WATER WELLS • VERTICAL TURBINE PUMPS • WATER TREATMENT

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WELL DRILLING
and other allied Drilling Services

ASK THE MAN FROM YOUR NEARBY LAYNE ASSOCIATE COMPANY—Layne-Arkansas Company, Stuttgart, Arkansas • Layne-Atlantic Company, Norfolk, Virginia • Layne-Central Company, Memphis, Tennessee • International Water Corporation, Pittsburgh, Pennsylvania • Layne-Louisiana Company, Lake Charles, Louisiana • Layne-Minnesota Company, Minneapolis, Minnesota • Layne-New York Company, Lindsay, New Jersey • Layne-Northern Company, Mishawaka, Indiana • Layne-Northwest Company, Milwaukee, Wisconsin • The Layne Ohio Company, Columbus, Ohio • Layne-Pacific, Inc., Seattle, Washington • Layne-Texas Company, Houston, Texas • Layne-Western Company, Kansas City, Missouri • International Water Supply, Ltd., London, Ontario, Canada • General Filter Company, Ames, Iowa (Complete Water Treatment)

CONTROL PARAFFIN

with

BrakeSol

at

LOW, LOW COST!

NOW is the time to set up a "control program" with the constant injection of economical BrakeSol. . . . the chemical that holds paraffin in suspension from formation to refinery. BrakeSol is the most effective chemical for treating all types of paraffin conditions. It is approved by refiners . . . contains no chlorinated solvents or other organic halides or sulphides. Contact your nearby BrakeSol Treating Engineer or Supply Store for information on how your paraffin problems can be eliminated economically. See our Exhibit at the IPE.

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P. O. BOX 9506 * OKLAHOMA CITY, OKLA.
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OIL • GAS • WATER • PRODUCTS PUMPING STATIONS AND PIPELINES

Books to Read

Competition in Oil, *by Daniel C. Hamilton. Published by Harvard University Press, Cambridge, Massachusetts. Pages, 233. Price, $6.75.*

The largest and historically the most influential refinery market for petroleum products in the world has been the Gulf Coast refinery market. It has even been alleged that Gulf market prices set a standard on which "price levels all over the world are based." In analyzing the character and extent of competition in this market from 1925-1950, the author deals with a matter of particular interest.

It is the first systematic study of the Gulf market structure and behavior to be published. Both the data it presents and the interpretation which accompanies it should interest the industry and the legal profession as well as the professional economist. Daniel C. Hamilton is manager of the Economics Department at Atlantic Refining Company and lecturer in economics at the University of Pennsylvania.

Maintenance Hints, *published by Westinghouse Electric Corporation, P. O. Box 2099, Pittsburgh 30, Pennsylvania. Pages, 650. Price, $2.*

This 24-chapter revised manual is a practical and complete guide to electrical equipment maintenance. Seventeen chapters cover specific apparatus maintenance; others cover general maintenance of materials used in apparatus, such as insulation. A new chapter has been added to the pocket-size handbook on maintenance of static controls and chapters on electronics and electric brakes have been considerably altered and enlarged.

Chapter VII, Heat Exchangers, Condensers, and Cooler Boxes, of the API Guide for Inspection of Refinery Equipment, *published by American Petroleum Institute, publications department, 50 W. 50th Street, New York 20, New York. Pages, 31. Price $2.*

This chapter includes a general description of types of equipment, reasons for inspection, causes of deterioration, frequency of inspection, preliminary work and tools, methods of inspection, limits of thickness, and records and reports. This is the first edition.

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for sealing, gasketing, pressure pads, vibration dampening — 100°F to 480°F

Low density COHRlastic R-10470 silicone sponge rubber is completely flexible after 72 hrs. at 480°F, shows no brittleness after 5 hrs. at −100°F. High tensile, tear and elongation. Closed cell construction is non-absorbing. Called out on aircraft and electronic drawings and specifications. Available from stock in sheets 1/16" thru 1/2", in rod .180" thru .585". Special extruded shapes made to order.

FREE SAMPLES and folder—write, phone or use inquiry service.

CONNECTICUT HARD RUBBER

NEW HAVEN 9 CHR CONNECTICUT

AIRFRAME SEALS | SILICONE RUBBER COATED FABRICS | SILICONE RUBBER SHEET & SPONGE | MOLDINGS & EXTRUSIONS

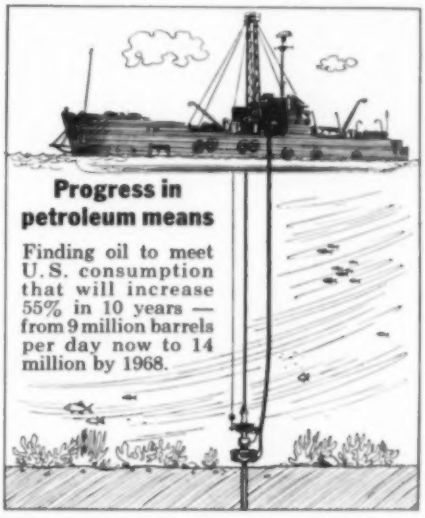
Navy landing ship converted by Standard for off-shore oil search. A 55-foot drilling mast is poised over circular 10-foot-wide opening from deck through bottom.

"Live" TV show 40 fathoms down guides our search for future oil reserves

With new oil becoming harder to find, our search widens. Now we're exploring the ocean floor — and new techniques are the rule. In one such venture we lowered a TV camera 250 feet below the waves to help guide the drilling of test holes from shipboard.

This is typical of the novel techniques used in our quest that last year took us to 21 states, Canada, Alaska and ten Latin American and Caribbean countries. In all, we drilled 120 exploratory wells. Although the cost ran to many millions, the successful ones helped us locate more new oil than we withdrew from the ground.

Actually, this benefits you as well as Standard. It means an adequate reserve of our most valuable national resource, to be drawn on in days ahead to provide the thousands of products from petroleum so essential for your daily needs.

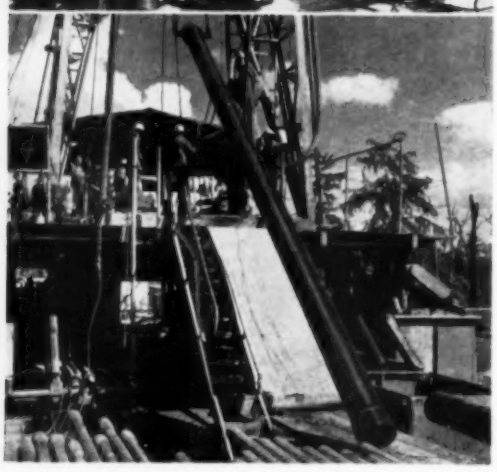


Progress in petroleum means

Finding oil to meet U.S. consumption that will increase 55% in 10 years — from 9 million barrels per day now to 14 million by 1968.

STANDARD OIL COMPANY OF CALIFORNIA *plans ahead to serve you better*

ARMCO CASING



ready when you need it from these NATIONAL® stock points

You can have casing ready to use when you need it—without increasing your inventories. Armco Casing is distributed by National Tank Company from 21 well-stocked locations throughout the oil country. When you have a rush job, a phone call to the nearest stock point will start your casing on the way. National's representatives also will handle your order for direct mill shipment promptly.

Armco Casing offers many advantages. The Armco Slip-Joint Collar permits fast, easy lineup and quick stabbing. Running time is reduced. Diameters range from 6 to 24 inches; wall thicknesses from 3/16- to 1/2-inch.

Armco Slip-Joint Casing is distributed by: National Tank Company, Tulsa, Oklahoma. In Canada: National Tank Company, Ltd., Edmonton, Alberta.

ELIMINATE LONG TRUCK HAULS BY CALLING THE NEAREST NATIONAL STOCK POINT.

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NATIONAL TANK COMPANY

TULSA, OKLAHOMA

Now...All Baroid Mud Testing Equipment Available Through Your Baroid Store

All mud testing equipment in the complete Baroid line is now available quickly through your nearest Baroid Store, or you can order direct from any Baroid Service Engineer. Write for complete catalog and price list.

BAROID

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ppm % vol cc lbs/cu f
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This AMERICAN IRON Double-Angle Insert is Outlasting ALL Others!

EVERY DRILLER who is using our new, exclusive double-angle inserts in American Iron Valve & Seat installations is reaping the benefits of these advantages:

- Lost circulation material is handled better.
- Perfect clearwater prime.
- More cushion is provided for valve impact on rapid close under high pressures.
- Made of finest materials, formulated and specified by our Research Laboratory, for longer-lasting more-effective service in your pumps!

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36 Years' Experience in Designing and Manufacturing Oil Field Equipment.

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Of Things To Come . . . In Oil

DRILLING AND DRILLING EQUIPMENT PURCHASES revenue should exceed the dollar volume reached in 1957, predicts the U. S. Department of Commerce. Basing its forecast on a 3.9 percent increase in oil demand this year, the department predicts that 53,000 to 56,000 wells will be drilled. Equipment improvements, "along with cost and needed price adjustments by producers for the benefit of drilling contractors, should result in increased production of drilling machinery and equipment in 1959," the report states.

"IT WILL BE NO SURPRISE if Louisiana again leads the nation in addition to reserves," says C. S. Wilkins, an executive vice president of the Mid-Continent Oil & Gas Association, in looking back over that state's 1958 oil picture. Wilkins points out that Louisiana is fast becoming the No. 2 oil state — despite reduced drilling activity and increased well abandonments in 1958.

SHUT-IN ORDERS FOR BISTI FIELD? New Mexico oil conservation commission has indicated that it will consider shutting in a majority of wells in Four Corners area of northwestern part of state because of gas waste. Commission's chief engineer Dan Nutter reports that 13 areas are venting an estimated 40,000,000 cu ft of gas per day. Most of waste is being attributed to north central and south central parts of Bisti field, and is increasing in Gallegos (Gallup) area. El Paso Natural Gas Company is working on plans for new gas pipeline in the area, with $4,000,000 budgeted for the project.

ROCKY MOUNTAIN DRILLING ACTIVITY is due to be strong through much of 1959, based on activity count at year's end in the Rocky Mountain-High Plains states area. Petroleum Information reports that "the strong finish promises continued high activity through the first part of 1959 . . . and there is at the present time no reason to expect the healthy level of activity will not continue through all of 1959." Some 300 rigs are running throughout the Rocky Mountain empire.

DOMESTIC OIL CONSUMPTION WILL OUTRUN SUPPLY in the first three months of the year, IPAA forecasts. In its supply and demand outlook, the association predicts that total consumption for first three months will average 10,330,000 bbl per day (3.8 percent higher than first quarter of 1958); domestic production of crude, natural gas liquids, crude imports and refined products are expected to average about 9,700,000 bbl per day — resulting in seasonal withdrawal from stocks of more than 600,000 bbl a day.

MOST IMPORTANT ADVANCES IN PUMP DESIGN IN 30 YEARS!

WHELAND *PLANETARY* HP-16000 SLUSH PUMP

DUPLEX POWER SLUSH PUMP 7¾" x 16"
600 HP at 65 RPM

U. S. Patent 2,649,988 and 2,717,186. Other patents pending.

NOW! **FOR THE FIRST TIME . . .**
these proven mechanical principles are applied to a slush pump!

- **PLANETARY GEAR SYSTEM**
  with gear cartridge assembled and inserted as a unit.
- **CROSSHEAD IS A PERFECT CIRCLE**
  thus stays perfectly aligned in every direction.
- **FLOATING INPUT SHAFT**
  with unique sheave mounting which lets shaft transmit torque load ONLY.

SEE OUR EXHIBIT

MAY 14-23, 1959
Tulsa, Oklahoma

Three years in designing, developing and in final field testing are behind this newest, most advanced WHELAND 16" PUMP. A folder giving the highlights of this new pump is yours for the asking . . . or we can give you current locations so you can see it in operation. You can't afford to buy any pump in this size until you've seen this new Wheland pump!

WHELAND
ROTARY DRILLING MACHINERY

THE WHELAND COMPANY
CHATTANOOGA, TENNESSEE, U.S.A.

DRAW WORKS • SLUSH PUMPS • ROTARIES
CROWN BLOCKS • TRAVELING BLOCKS • SWIVELS

DOMESTIC DISTRIBUTORS: INDUSTRIAL SUPPLY COMPANY, INC.—Main Office: Wichita Falls, Texas • HOUSTON OIL FIELD MATERIAL COMPANY, INC.—Main Office: Houston, Texas • JONES AND LAUGHLIN STEEL CORPORATION, SUPPLY DIVISION—Main Office: Drawer 2481, Tulsa 2, Oklahoma.

EXPORT DISTRIBUTORS: LUGEY EXPORT CORPORATION—233 Broadway, New York 7, New York—Broad Street House, London, E. C. 2, England.

STOP JET EROSION ON TUBING with GUIBERSON'S

TUBING PROTECTOR RUBBERS

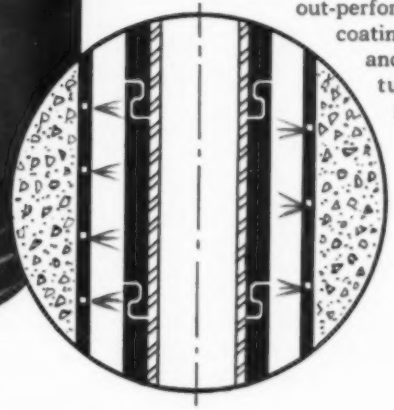
INTERLOCKING TYPE

Protect that joint of tubing opposite casing perforations from jet stream impingement with Guiberson rubbers. Tough and resilient, they absorb the jet stream energy that erodes away steel tubing.

Compression molded from a special compound developed in Guiberson's Rubber Laboratory, these extra-dense rubbers have highest resistance to live oil and gas.. excessive bottom hole temperatures. At the same time, they eliminate cutting and abrasion by sand.

Self-aligning, interlocking design completely covers tubing and speeds up installation (no exposed gaps). We field install them at no extra cost to stay put on 2" or 2½" tubing. They snap into place under light tension.

Independent laboratory tests, made under the severest sand and live oil jetting conditions, show Guiberson tubing protector rubbers out-perform and far outlast other coatings..such as lead, plastics and hard metal. Guiberson tubing protector rubbers not only save tubing, but may save a pulling job.



THE GUIBERSON CORPORATION

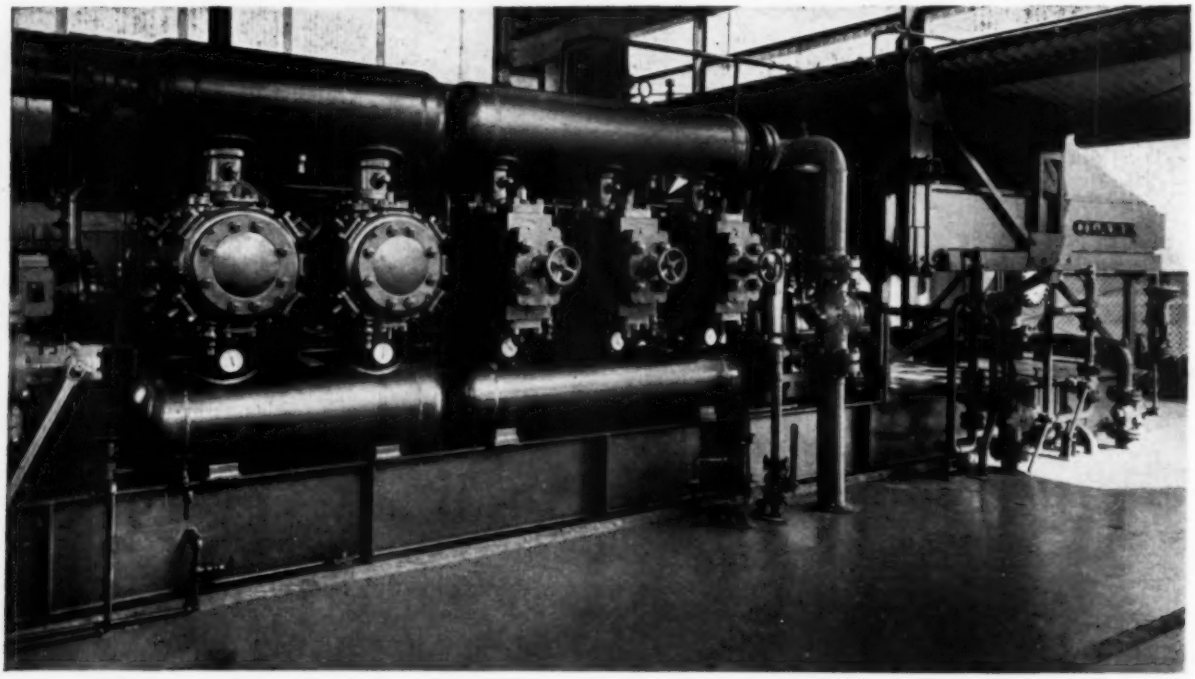
ESTABLISHED 1919

DALLAS, TEXAS U. S. A.

Guiberson's overlapping type tubing protector rubbers are available in 2" and 2½" tubing sizes. The 2" size is designed to pass through Guiberson drillable packers.

OVERLAPPING TYPE

Clark "Midget Angle" Compressors



in Shell gas boosting plant give . . .

Above: Close-up of Clark balanced/opposed HMB-10 compressor in Shell gas boosting plants.
Below: Located in the Main Pass Area of southern Louisiana, plant stands in 12 feet of water, several miles offshore.

Designed specifically for field service, Clark "midget angle" packaged compressors are ideal for areas with unstable soil conditions such as offshore and bayou – and for trailer, barge and platform mounting. For example, in this offshore gas boosting plant of the Shell Oil Company in Louisiana, two Clark "midget angle" HMB-10's are mounted on a concrete platform 34 feet above sea level, supported only by six 24-inch steel pilings.

The task of moving gas to land market miles away is handled by these Clark HMB-10's with smooth efficiency. They handle gas at 40 lbs. suction to 1000 lbs. discharge. Each unit is completely self-contained, with gas-engine-driven compressors, radiators, scrubbers, starting air compressor and accessories all mounted on a single heavy-steel skid. The balanced/opposed design virtually eliminates vibration. Moreover, Clark engineering and heavy-duty construction assure low maintenance and extra-long life. These are some of the reasons why over one thousand dependable Clark "midget angle" compressors are currently in use.

SUPER SERVICE ON STILTS

Your nearby Clark sales engineer will gladly help you select the right type and size of compressor for your next installation. Contact him or write for Bulletin No. 151, Clark Bros. Co., 1214 Lincoln Avenue, Olean, N. Y.

CLARK BROS. CO.

One of the Dresser Industries

Sales and service outlets in principal cities throughout the world.

CLARK

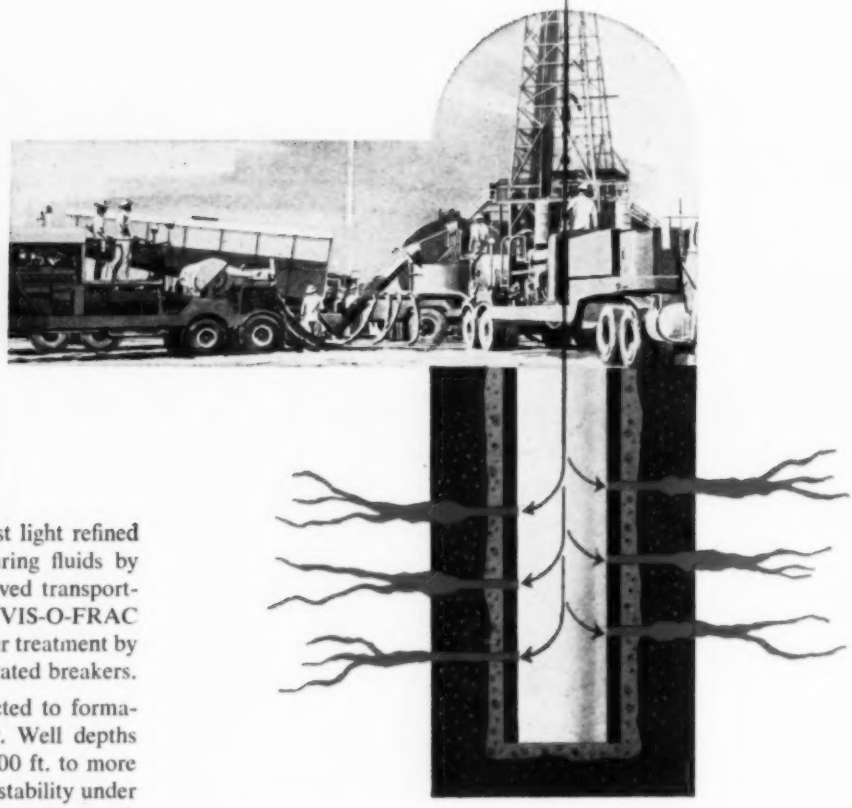
Main view of plant shows 2 Clark "midget angle" HMB-10 field-packaged compressors, each developing 550 hp.

Radiator end of Clark HMB-10. Note the simple, compact mounting of unit on single steel skid.

convertability!

A BIG FEATURE OF HALLIBURTON

vis-o-frac



...converts crudes and most light refined oils into more suitable fracturing fluids by continuous jellation for improved transporting of sand into the formation. VIS-O-FRAC reconverts to low viscosity after treatment by dilution and action of incorporated breakers.

VIS-O-FRAC is not restricted to formation characteristics or locality. Well depths have varied from less than 1000 ft. to more than 13,000 ft. demonstrating stability under a wide range of temperatures...with excellent results.

VIS-O-FRAC preparation is not restricted by surface temperature, even in sub-zero weather.

VIS-O-FRAC is economical, meeting today's demand for low cost well completions.

Let your
Halliburton Representative
tell you more
about Vis-O-Frac.

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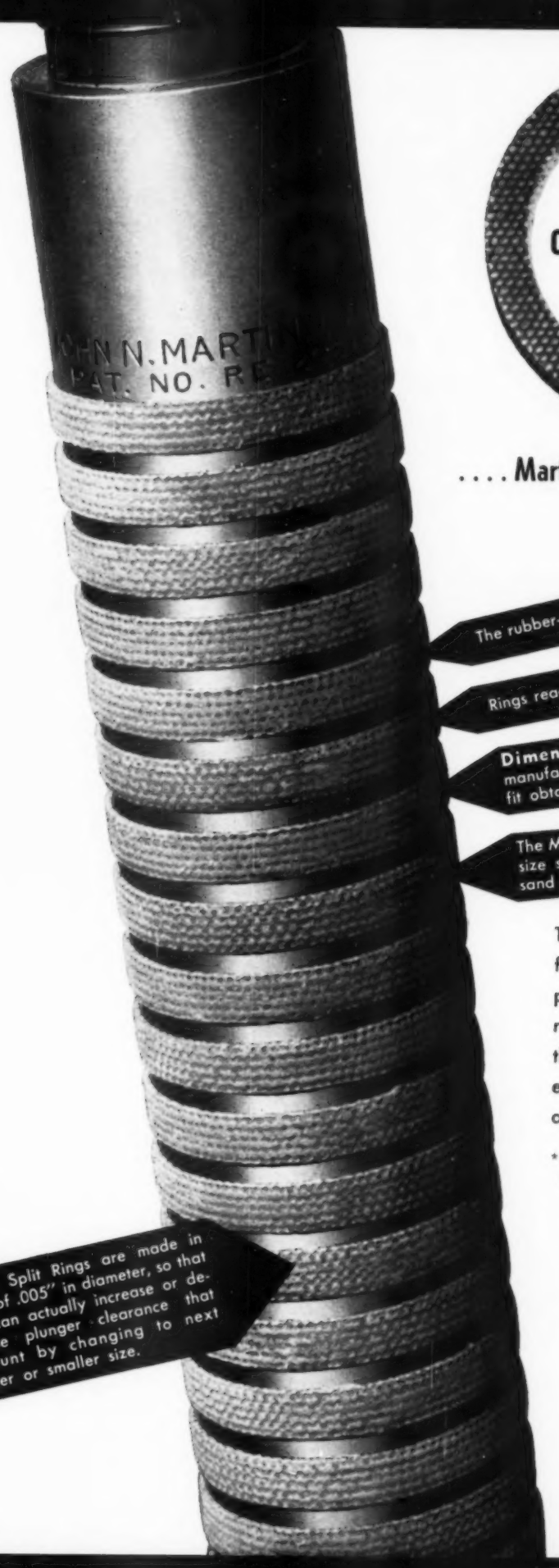


GETTING CORRECT RING FIT IS EASY WITH

.... Martin Plungers and the Martin Method of Installation*

The rubber-and-duck rings swell **just so much** and no more.

Rings reach maximum size in the well within a few hours.

Dimensional Compensation during the manufacturing process assures the uniform working fit obtained with Martin Split Rings.

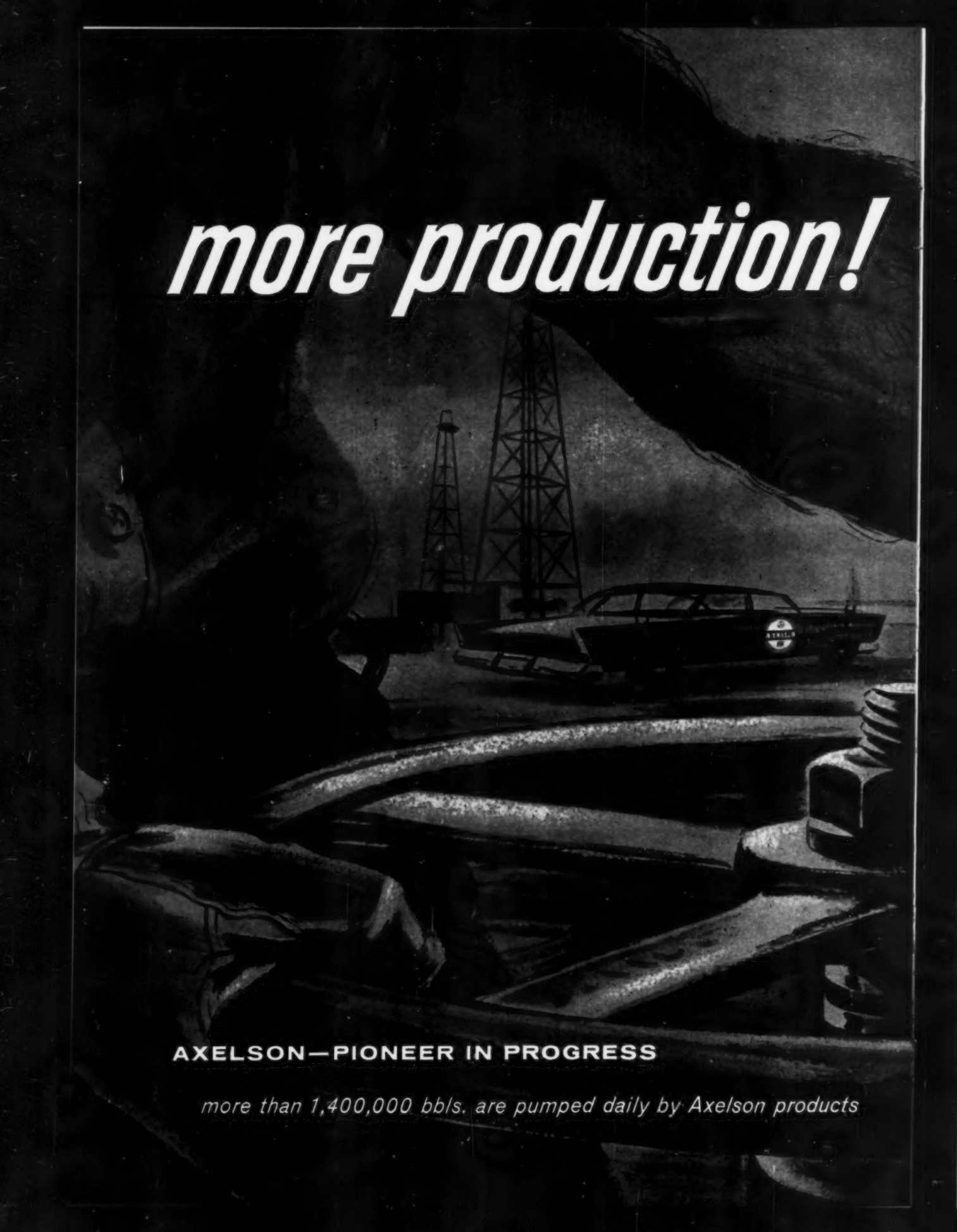
The Martin Ring Size Guide Table* assures proper ring size selection for various gravities, temperatures and sand and water content.

Martin Split Rings are made in steps of .005" in diameter, so that you can actually increase or decrease plunger clearance that amount by changing to next larger or smaller size.

The gaps between the Martin Rings cause fluid turbulence which slows down slippage past the Martin Plunger — just as a rough road slows down your driving speed. Actually, the Martin Plunger maintains pumping efficiency with a looser fit than is possible with a smooth surface plunger.

* See the complete Martin Catalog and instructions in the 1957 Composite Catalog.

JOHN N. MARTIN
Manufacturer
9 W. BRADY • TULSA, OKLA.


more production!
AXELSON—PIONEER IN PROGRESS
more than 1,400,000 bbls. are pumped daily by Axelson products

22%-60% MORE *with*

AXELSON VOLUMAX

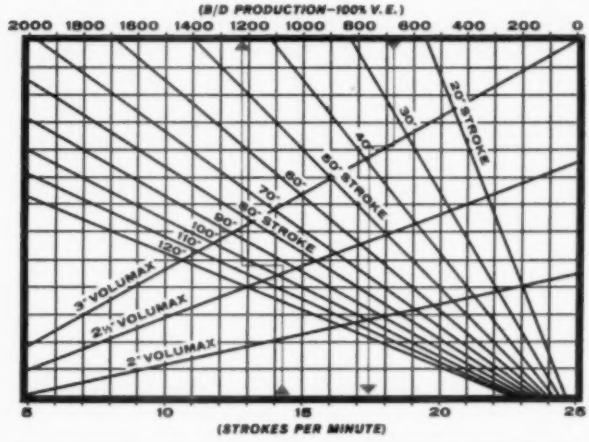
for example:

- In 2" tubing, 2" Volumax (1½" bore) outproduces insert pumps by 66% – tubing pump by 22%.
- In 2½" tubing, 2½" Volumax (2" bore) outproduces insert pumps by 63% – tubing pump by 29%.
- In 3" tubing, 3" Volumax (2½" bore) outproduces an insert pump by 53% – tubing pump by 27%.

PERFORMANCE FACTS

- An insert-type pump, the Volumax allows entire subsurface pumping equipment to be pulled with rods.
- Volumax achieves more production than tubing pump without changing stroke length or cycles per minute.
- Produces equal volumes as tubing pump at reduced cycle rate, reduces dynamic stresses in rod string.
- Allows use of shorter stroke surface unit in shallow, high volume wells.

HERE'S HOW TO APPLY THE VOLUMAX



REPLACE WITH AXELSON

Axloy Balls and Seats, made of a special analysis of stainless steel, are extremely durable under all pumping conditions. Each highly polished ball is mated with its own seat and tested under vacuum to insure perfect action.

Write for New Volumax Pump Brochure

NEW VOLUMAX PUMP

USI Axelson

DIVISION OF U. S. INDUSTRIES, INC.

6160 SO. BOYLE AVENUE • LOS ANGELES 58, CALIFORNIA • LUdlow 7-1271

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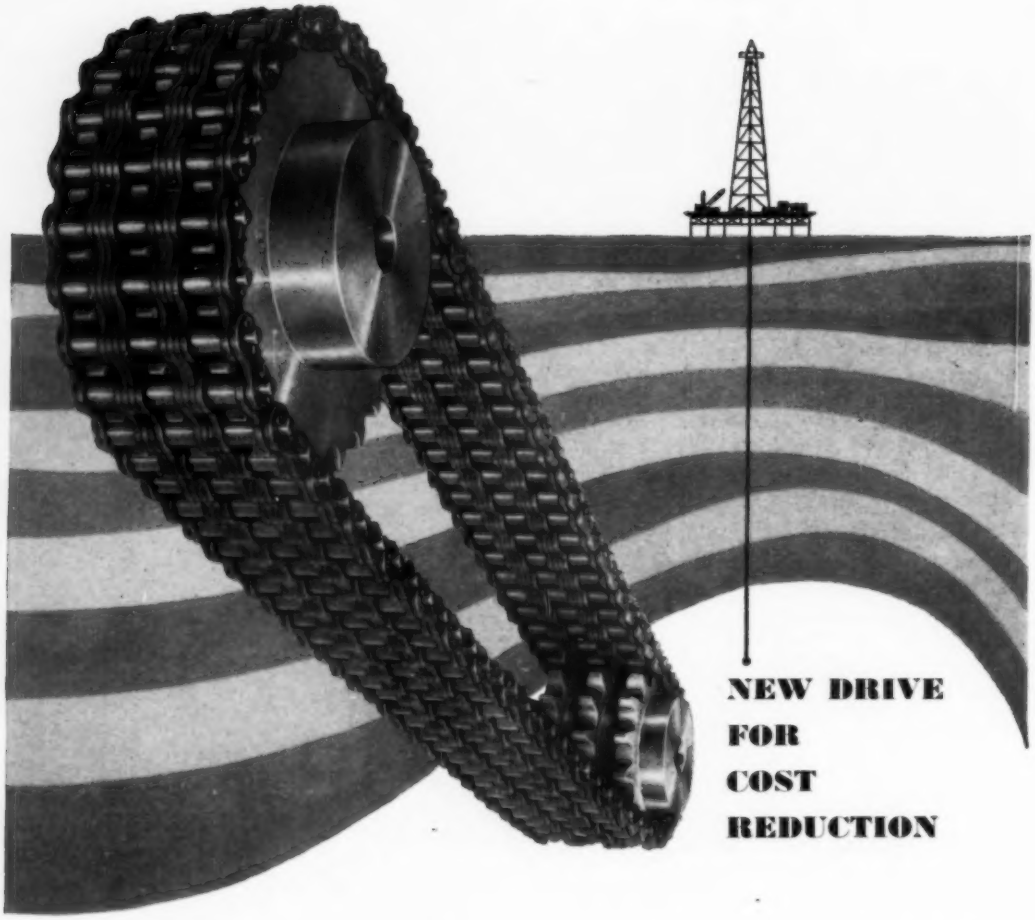

NEW DRIVE FOR COST REDUCTION

Whitney's *new* chain drive developments are helping to reduce oil field production costs *where it counts* . . . keeping rigs operating under the toughest shock loads and punishment that drilling schedules can hand out.

Here's why important producers everywhere are specifying these new cost-cutting chain drives:

√ An exclusive *fatigue-resistant* Whitney Process offsets *excessive operational stresses* in the chain —assures new durability and freedom from excessive wear, breakage and dollar consuming downtime. Each precision Whitney Chain part is specifically designed, heat treated and assembled to meet your severest service requirements.

√ And Whitney's "*Fluid-Fit*" design features all cottered chain construction with slip-fit link assemblies . . . no tough, time wasting repair work when assembling or adjusting your chain drives.

√ Another important design advance is Whitney's High-Capacity Roller Chain. This new, *compact* chain drive may provide an engineered solution where space limitations and higher horsepower requirements are important factors in power transmission.

Backing up these design advances is Whitney Chain *service* . . . a complete line of packaged, precision steel chain, always available from oil country warehouses and oil field supply stores everywhere. Each point brings you field *engineering service* and prompt delivery from stock. Write for complete, practical catalog literature.

Whitney

CHAIN COMPANY

423AN Hamilton St., Hartford 2, Conn.

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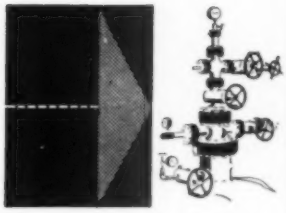

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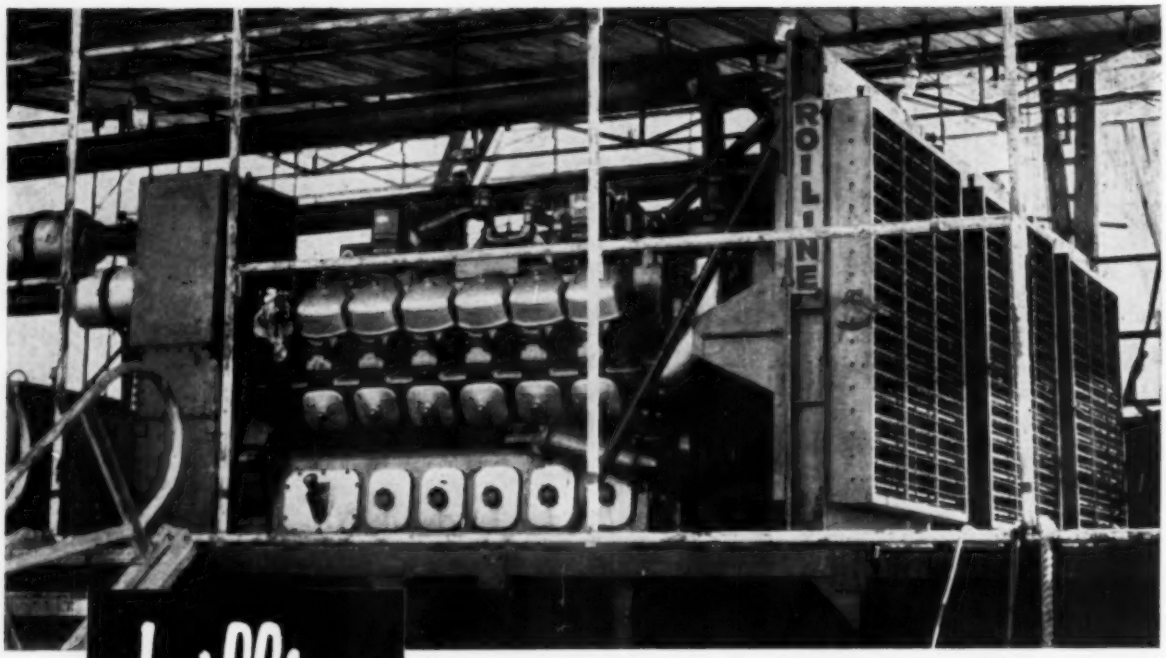

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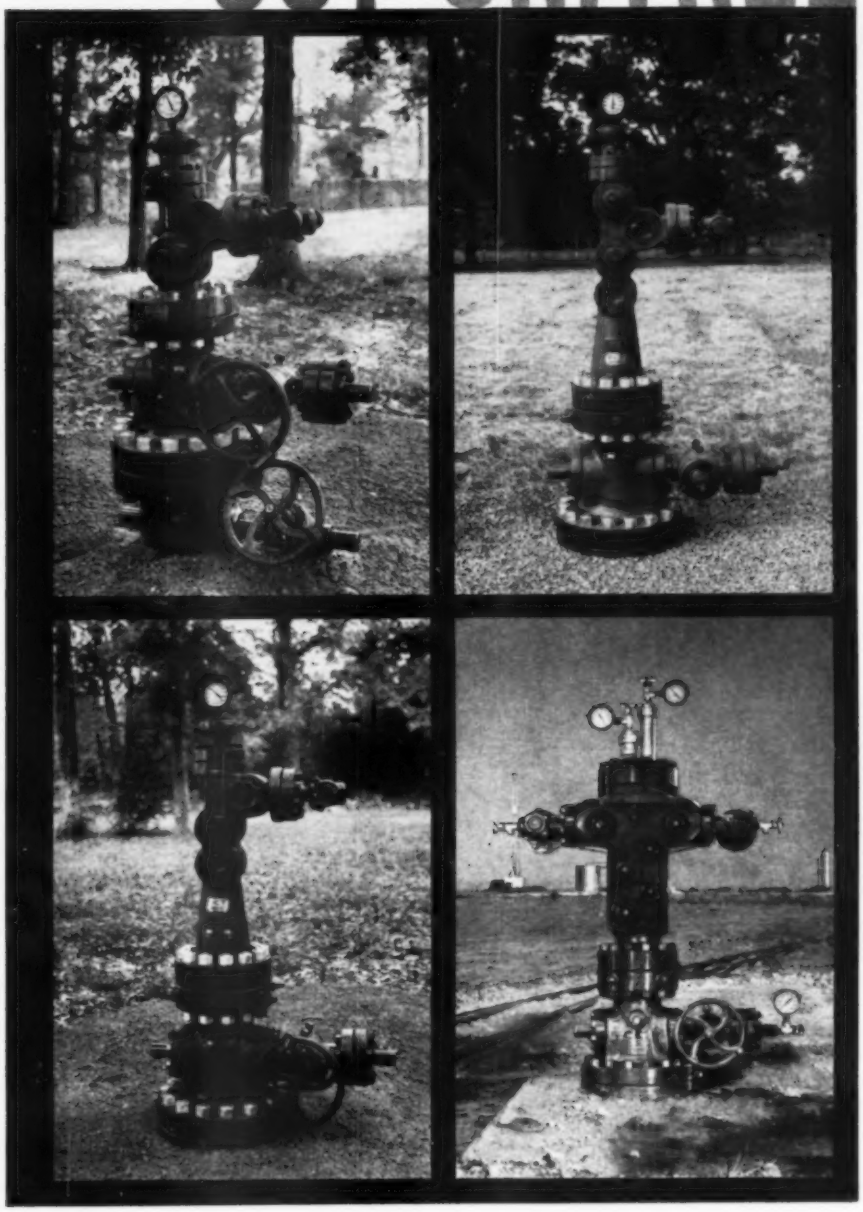

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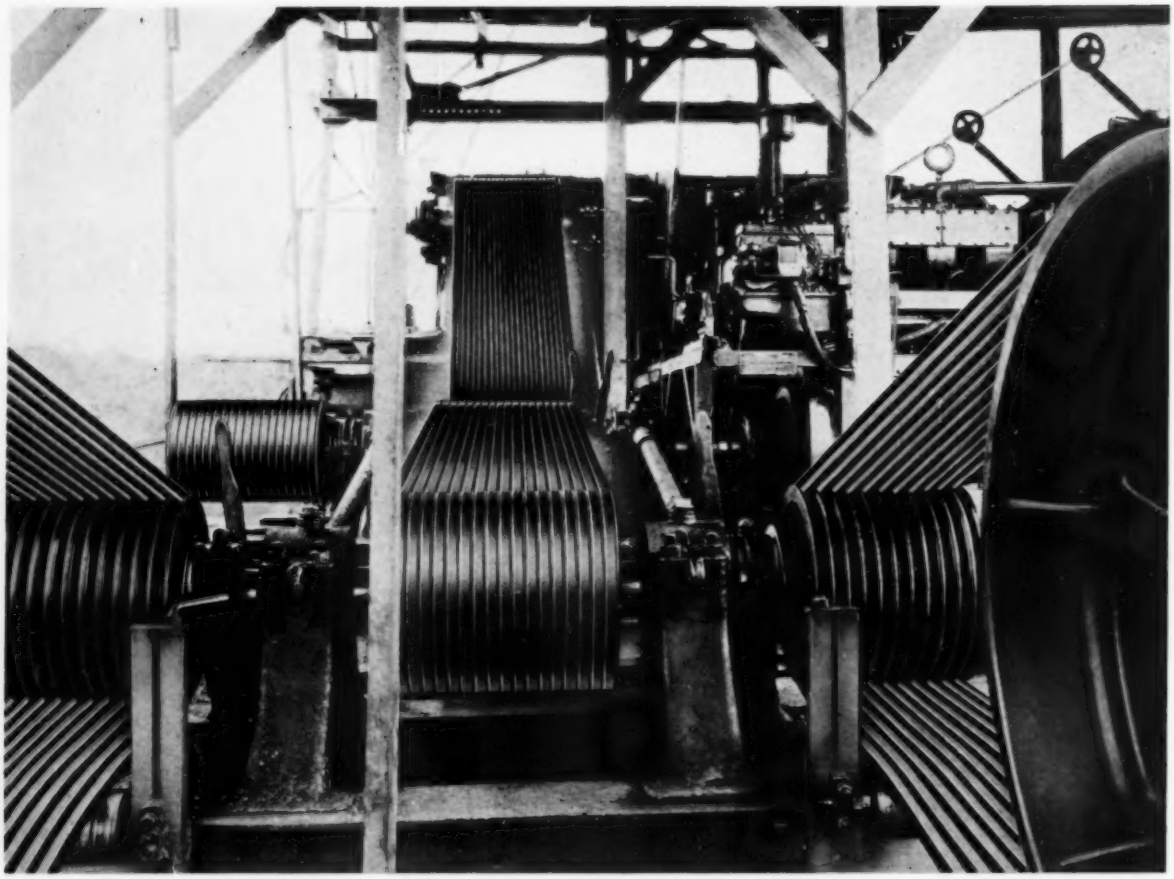

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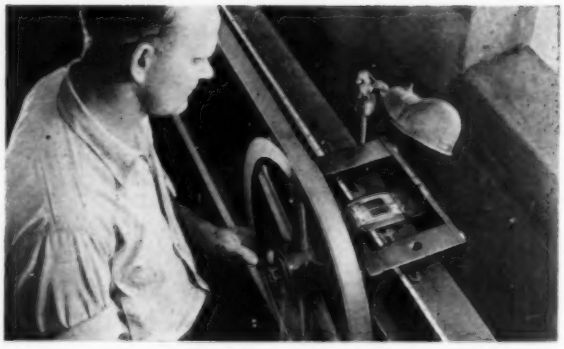

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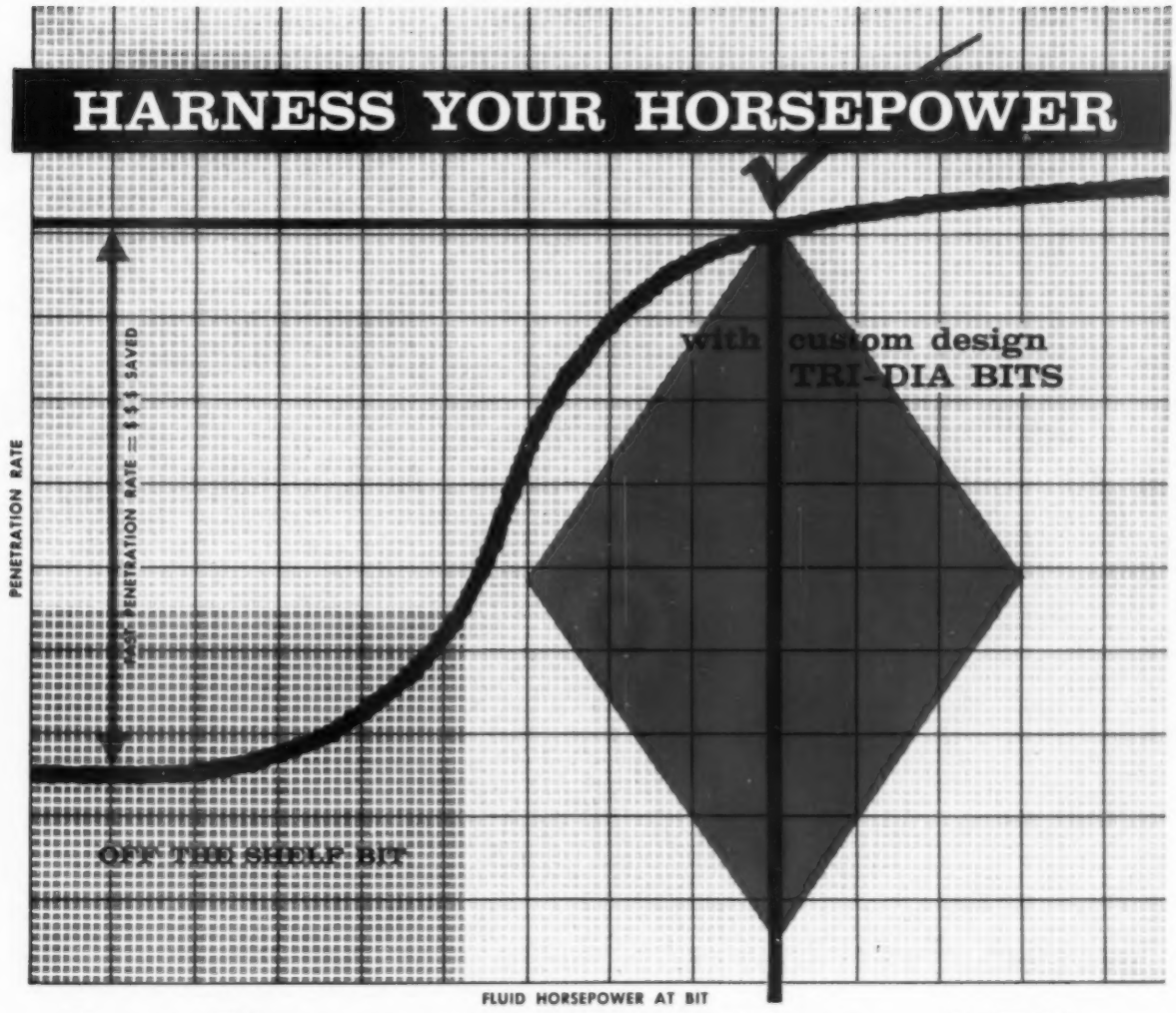

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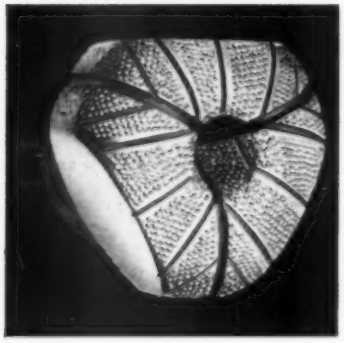

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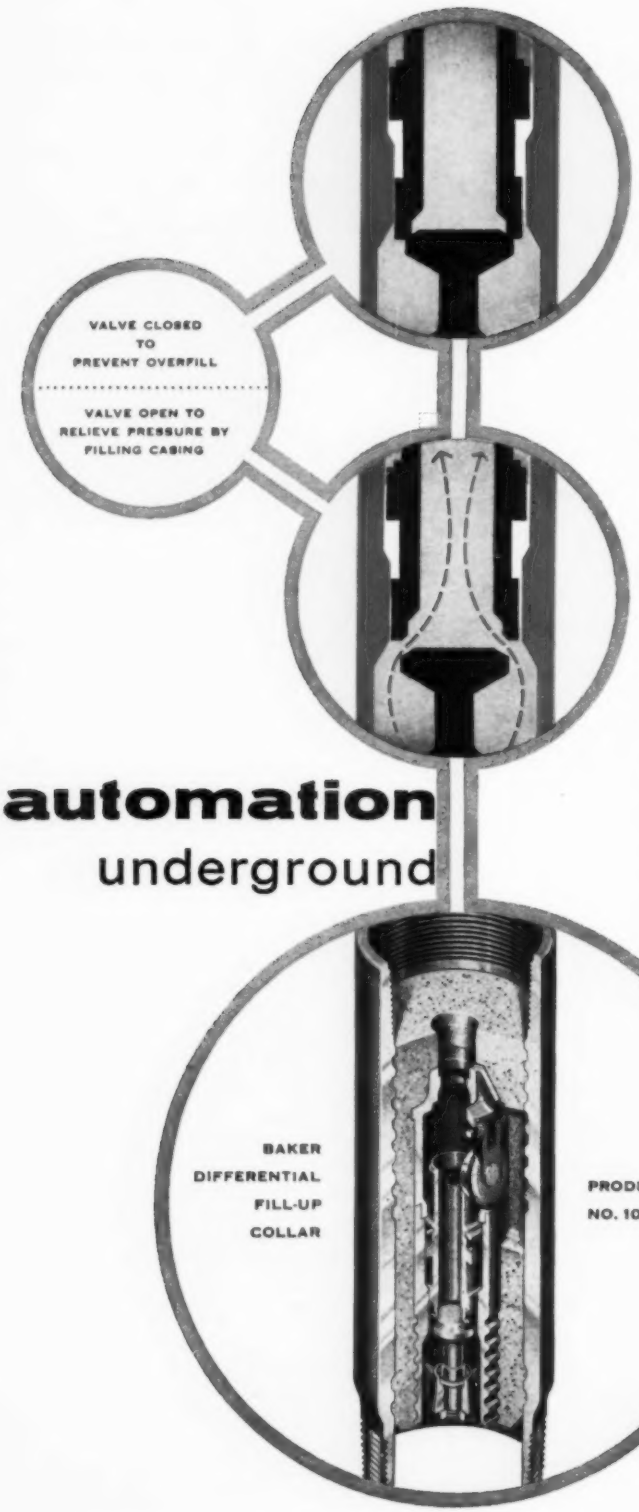
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Gas Injection for Attic Oil Recovery

- *Pilot project substantiates updip oil recovery technique by downdip gas injection*
- *Single producing-injection well in B-55 sand, Venice field, previously watered out, now produces at peak rate*

J. C. Broom and A. L. Dawsey, Jr.
Tidewater Oil Company
Lafayette, Louisiana

A PILOT PROJECT of attic oil recovery by downdip gas injection is underway in the Venice field, Plaquemines Parish, in South Louisiana. The injection phase was completed on the Tidewater Oil Company's Buras Levee District Well No. 55 on May 29, 1958, and has flowed at top allowable since that time. Prior to the gas injection, the well had watered out, producing about 98 percent water and only a few barrels of oil.

Venice field lies around the Venice dome near the mouth of the Mississippi River in South Louisiana. The field has a piercement-type salt dome structure and is presently nearing completion of development, after nearing nearly 20 years of continuous drilling activity.

There are many radial fault blocks that apparently have been fully developed, but which obviously contain marginal oil reserves updip of all penetrating wells. Since most of these reservoirs have a prolific water drive, their pressures remain nearly constant. This causes the wells to water out before the attic oil can be recovered by such natural processes as solution gas drive, gas cap expansion and gravity drainage. Because of the poor structural control of these attic regions, and their marginal size, it is impractical to attempt drilling to them.

These field characteristics suggested the use of this novel recovery process, involving the injection of gas into attic reservoirs through the structurally highest well after it has produced all recoverable downdip oil and is being, or already has, watered out. The basic principle of the process is that the lighter density gas will migrate updip and displace downward previously non-recoverable oil trapped in the attic region of the reservoir.

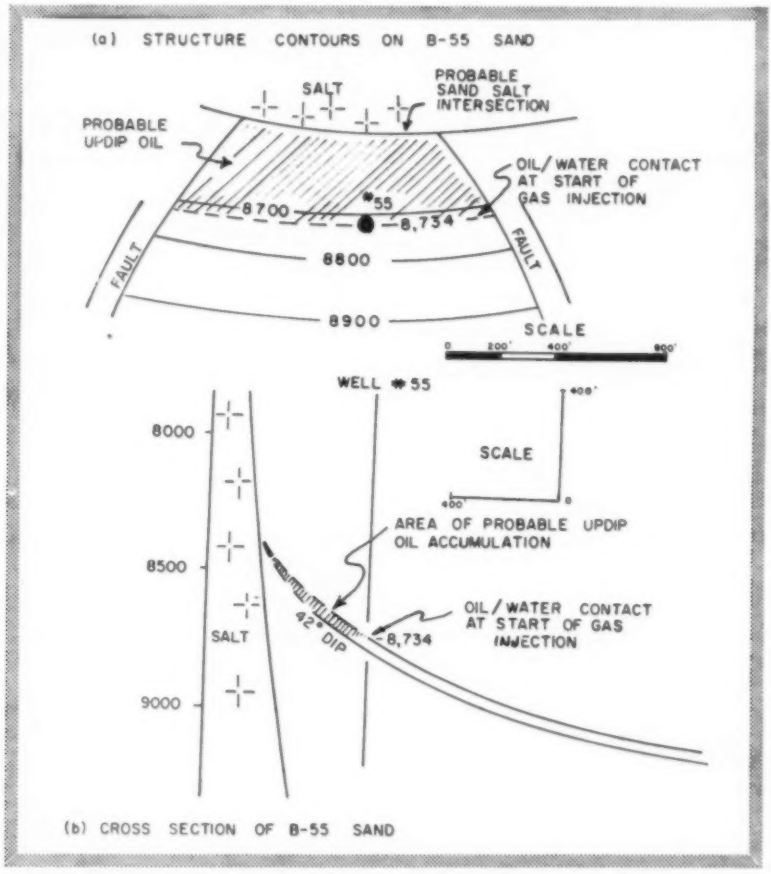

FIG. 1. **Probable updip oil accumulation** in the B-55 reservoir, Venice field. In the structural contour map (a), the oil/water contact line is shown near well BLD No. 55, at the beginning of the gas injection phase. The cross section (b) shows the steep-dipped B-55 sand reservoir against the Venice dome.

B-55 Selected

The B-55 reservoir, shown in Fig. 1, was selected as the initial trial unit for updip oil recovery by downdip gas injection based on its following characteristics:

1. The existing reservoir pressure was considerably above bubble-point pressure. This precluded existence of a gas cap, insuring that all updip portions of the reservoir contained undersaturated oil.

2. The reservoir had a high permeability and dip angle. This allowed a satisfactorily high rate of gas/oil segregation in the reservoir during gas injection.

3. The sand development was fairly uniform for efficient displacement of the updip oil by the injected gas. The sand consisted of a single continuous section, into which all injected gas would be known to go.

4. The well was almost completely watered out, producing 1100 bbl salt

water per day and only 20 bbl of oil per day. This insured that clean oil production established after gas injection would be mainly from updip reserves.

5. The reservoir contained but one completion. This insured simplicity and ease in initiating the project and in evaluating the results.

6. The reservoir lay entirely under one lease having one operator. This avoided the complications associated with unitization for such a novel trial project.

7. The reservoir had shown a large index of total barrels reservoir fluid production per psi drop in reservoir pressure. This was additional evidence that a secondary gas cap had not already formed in the updip portion of the reservoir.

8. The B-55 sand had been penetrated by a sufficient number of wells to provide adequate data for reliable reservoir structural and isopachous maps.

The gas injection into the selected well, BLD No. 55, began January 13, 1958, and was completed in about four months, including intermittent testing. While injecting gas, a top daily allowable was being accredited to the well, pending its later capability to produce. After injection was completed, the well was granted a double allowable for a period of three months to make up its accredited allowable. It has since been producing at normal depth allowable.

TABLE 1. Physical Data B-55 Sand.

Sand	
Porosity, percent	36
Permeability, millidarcies	1,370
Interstitial water, percent	16
Net thickness, feet	30
Average dip of bed, degrees	42
Fluid	
Oil gravity, deg API	37.7
Solution gas gravity	0.65
Reservoir temperature, F	182
Solution gas/oil ratio, cu ft per bbl	785
Formation volume factor	1.37
Saturation pressure, psi	3,700
Oil/water contact: —Before Injection	—8,734

TABLE 2. Status of Pilot Injection Well BLD No. 55 Before and After Gas Injection.

Date	1-1-58	6-1-58
Oil production daily, bbl	20	157
Water production daily, bbl	1,100	None
Percent water production	98%	0
Gas/oil ratio, cu ft per bbl	900/1	900/1
Tubing pressure, psi	150	1,600
Casing pressure, psi	900	0
Wellhead choke size	None	7/64"
Producing method	Gas Lift	Flowing
Producing reservoir	B-55	Unchanged
Producing perforations	8,734-750	Unchanged
Total gas injected, MMcf	None	208

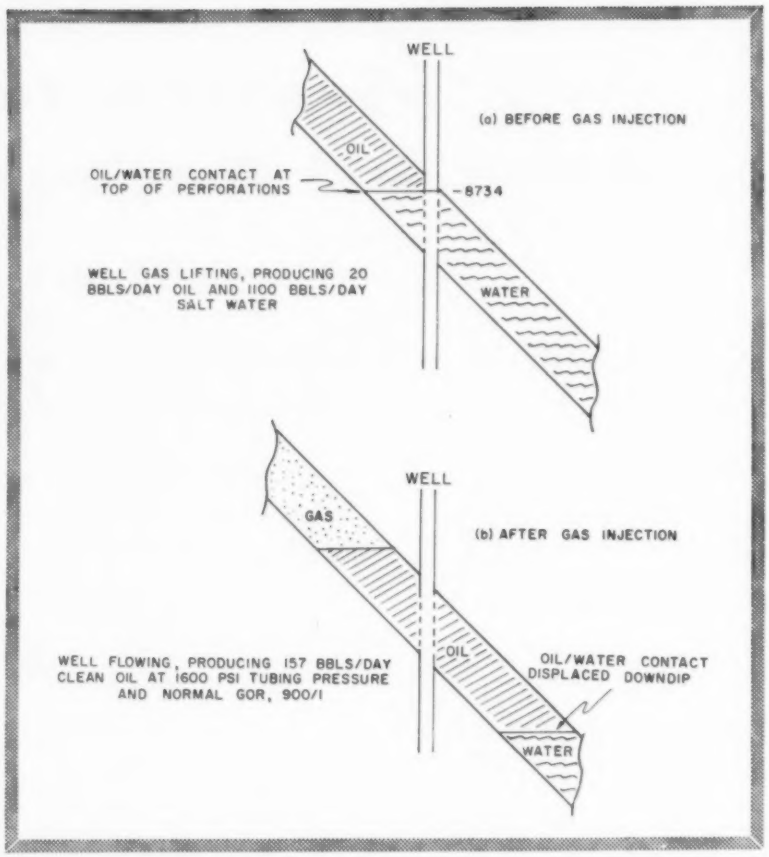

FIG. 2. **Before and after gas injection** into BLD No. 55, cross section drawings of the B-55 reservoir as it probably appeared. Section drawing (a) shows the unrecoverable oil above the well perforation depth. Gas injected into the same well resulted in gas accumulation updip with oil displaced back to productive interval (b).

A total gas volume of 208 MMcf was injected into the B-55 reservoir, displacing an estimated 120,000 bbl oil from the updip attic region. Over 23,000 bbl of pipeline oil have already been produced since injection, with an additional 30,000 bbl anticipated before the injection-producing well shows a water-cut. An additional 100,000 bbl production is indicated before the well again waters out; however, additional gas will probably be injected at the first show of water. Apparently, there is still additional updip oil in the reservoir since the induced gas cap is still above the perforated interval.

The probable updip oil accumulation in the B-55 reservoir is illustrated in Fig. 1. The position of the oil/water contact before and after gas injection is shown in Fig. 2.

Gas Injection

The injection gas was furnished by a gas well on the same lease. The gas was flowed naturally into the injection well, after being scrubbed of its liquid condensate. A diagram of the surface facilities utilized is shown in Fig. 3. The natural flow of gas from the gas well into the injection well resulted in a smooth, trouble-free operation requiring practically no maintenance or supervision.

Since no well work was required for either the watered-out injection well or the source gas well, the only capital investment needed was for minor surface facilities, most of which were on-hand inventory items. This investment cost was less than 10 percent of the estimated cost of drilling to this updip reserve, though such a well could not drain this attic region nearly as effectively as gas displacement, even if its penetration was ideally located.

The basic economic justification for this injection process is that gas may be traded for oil as long as the price of a unit volume of reservoir oil is sufficiently greater than the price of a corresponding unit volume of reservoir gas. Under present prices where oil is selling for approximately $3.24 per bbl and the gas from this field, under an old contract, is selling for approximately 8 cents per Mcf, about

$20 worth of oil and associated gas is recovered for each $1 worth of gas injected. This results in approximately a 20 to 1 trade ratio at the price presently being received for the two products. Of course this ratio would probably change if the prices of the products were to change.

A very important benefit from the process is a decrease in rate of salt water production for the field. The gas injection project on Buras No. 55 reduced the rate about 1100 bbl per day. When enacted on all prospective Venice wells, the field water production rate should be reduced more than 50 percent. This will materially reduce the field cost of such items as pipe corrosion, water handling facilities, and gas lifting, all associated with producing oil having large water cuts.

Remaining Downdip Oil Reserve

A comparison was made of the downdip volumetric reserve estimate and the cumulative oil production. The original downdip volumetric recoverable reserve was 347,000 bbl of stock tank oil, while the cumulative production to the time of injection was 325,000 bbl. The well's water/oil ratio history up to that time indicated a remaining recoverable reserve of about 20,000 bbl. It was producing 1100 bbl of salt water plus only 10 to 20 bbl of oil daily, which was near its economic limit.

The close agreement between volumetric reserve, 347,000 bbl, and anticipated recovery, 345,000 bbl was reasonable evidence that the downdip portion of the reservoir was nearly depleted. Prolific oil production established after gas injection would then be from updip reserves.

Estimation of Updip Oil Reserve

The acre-feet of the reservoir existing upstructure from the injection well penetration was estimated by extrapolating the known sand structure updip to probably intersection with the adjacent salt stock. This probable updip area of oil accumulation is shown in Fig. 1. It was believed that the displacement of the updip oil by the injected gas would resolve into a normal gas drive as the gas traveled updip, saturating a channel joining the well bore and the expanding gas cap. Accordingly a recovery factor, estimated at 60 percent from core data, was applied to the calculated updip oil-in-place.

The updip oil reserve estimate of 120,000 bbl was later found to be conservative, for, after injection of the corresponding quantity of displacement gas, the gas/oil contact was still above the top of the perforated interval since only oil of normal GOR was later produced.

When gas injection is resumed, periodic production tests will be made and the injection will be halted when a high GOR test is observed. This should occur when the expanding gas cap has reached the perforated interval. The total gas injected up to that time should give a measure of the displaced attic oil reserve.

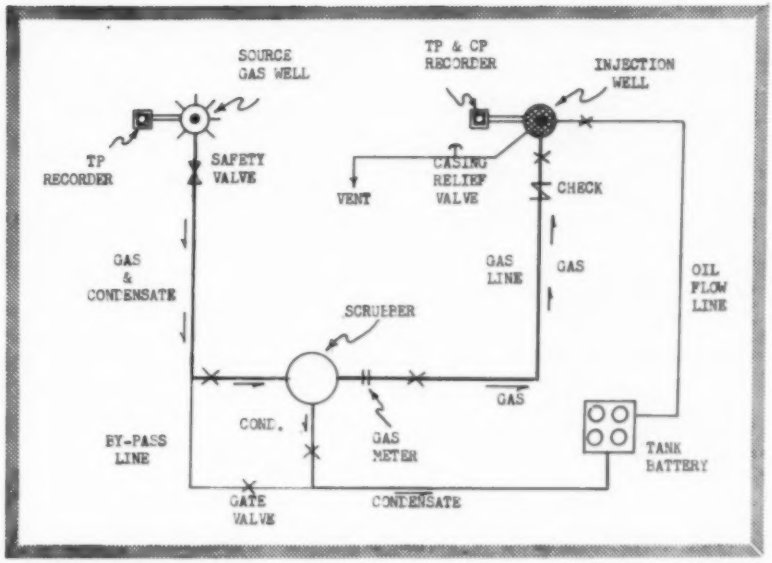

FIG. 3. **Gas injection surface facilities.** After scrubbing, gas from well BLD No. 24 flowed naturally to the injection well, with little or no maintenance or supervision. Injection pressures ranged from 3250 to 3350 psi.

Surface Installations

Having selected a trial injection well, a lease gas well, Buras No. 24, was found to contain sufficient gas at the required pressure to do the job. The necessary surface facilities were then installed, as shown in Fig. 3. These facilities consisted primarily of: (1) A scrubber for separating liquid condensate from injection gas; (2) A gas meter for injection gas volume measurement; and (3) Surface lines extending from gas well to scrubber, scrubber to injection well, scrubber to tank battery, and injection well to tank battery.

The source gas well was equipped with a surface safety valve and a recorder installed to provide continuous tubing and flowline pressure readings. A 2 in. tubing flowline was laid to the injection well. The gas was scrubbed at about 3300 to 3400 psig, metered, then injected into the well. The fluid was dumped to the battery, metered and stored in stock tanks.

The injection well was equipped with a check valve just upstream from the wing valve on the injection side, a recorder for continuous pressure readings on the tubing and casing and a 500

THE AUTHORS

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A. L. Dawsey, Jr. *is area engineer at Venice field for Tidewater. He received a BS degree in petroleum engineering in 1951 from Louisiana State University. He was initially employed by the Stanolind Oil & Gas Company serving two years as a field production engineer in South Texas. Following two years of military service, he joined Tidewater in 1955 and has since served as field production engineer in South Louisiana.*

psig relief valve on the casing. The relief valve served to prevent casing damage if a leak developed in the tubing string.

Prior to gas injecting into Buras No. 55, the well was gas lifting, through retrievable gas lift valves. These valves were pulled and replaced with dummy valves to prevent tubing-casing communication. The tubing was then tested to 3500 psig with water in the string. The injection line, scrubber and meter run were also filled with water and pressure tested to 4000 psig.

Injection Testing Procedures

Gas injection into well No. 55 was commenced January 13, 1958 at the rate of 2500 Mcf per day. Initial injection pressure was 3300 psig which dropped to 3250 psig within the first hour. A very gradual increase in this pressure was noticed the first four days, the maximum being 3300 psig. After four days of injection, the rate was decreased to 2000 Mcf per day. The injection well tubing pressure was lowered to 3250 psig as a result. Maximum injection pressure was 3350 psig, recorded near the end of injection.

Periodic production tests were conducted to evaluate the progress of injection and to prevent over injection. The first test was run after 57,499 Mcf gas had been injected, and the well shut-in for 24 hours to allow for oil and gas segregation. After flowing the well for six hours, the following was produced:

610.5 Mcf gas
11 bbl salt water
traces of sand

The test was started on an 11/64-in. choke but later raised to 12/64-in. because of the sand being produced. The well was shut-in for an additional 48 hours prior to conducting the second test. The following are the results of this test:

96 bbl of pipeline oil
646 bbl of salt water per day
132 Mcf gas
87% bs&w
1375/1 GOR
34.4 deg API

The well was opened on an 11/64-in. choke but gradually increased to a 20/64-in. choke because of sand and water production. The tubing pressure during this producing period ranged from 3250 psi at the start of the test to 250 psi during the test. The first fluid to hit the surface was 100 percent clean oil. This lasted for approximately 1 hour, then the well went to 100 percent salt water. The salt water percentage gradually decreased until, at the end of the test, it was 80 percent. Large quantities of sand were produced especially during the high salt water production. The well was taken off test and gas injection resumed.

The third test was conducted March 28, 1958 after 104,356 Mcf gas had been injected. This was a 6 hour test and resulted in the following, after being shut-in for 72 hours.

579 bbl of pipeline oil
550 Mcf gas
1/10 percent bs&w
949/1 GOR
Tubing pressure: 1600 psig
35.5 deg API
13/64-in. choke

The fourth test was conducted April 17 after 136,353 Mcf gas had been injected. The well was shut-in for 48 hours and tested for 4 hours. The results are as follows:

385 bbl of oil per day
366 Mcf gas per day
1/10 percent bs&w
956/1 GOR
Tubing pressure: 1600 psig
36.6 deg API
10/64-in. choke

The fifth test was run after injecting 180,243 Mcf gas. Shut-in period prior to testing was only 24 hours. A 19-hour test was conducted which resulted in the following:

277 bbl of oil per day
330 Mcf gas per day
1195/1 Avg. GOR
1/10 percent bs&w
Tubing pressure: 1600 psig
9/64-in. choke

A total of 208,348 Mcf gas was injected before sustained production was attempted. The well was shut in for 72 hours to allow for oil and gas segregation and then placed on production. In seven months of production since injection, this well has produced more than 23,000 bbl of pipeline oil with normal GOR and no water, and is still producing in this capacity.

The injection phase was completed in the Buras No. 55 on May 29, 1958, and the well has flowed at top allowable since that time.

A second pilot injection well has been selected, the BLD No. 5, and the injection phase is still in progress. Actual gas injection in this well, however, is temporarily halted during a testing period.

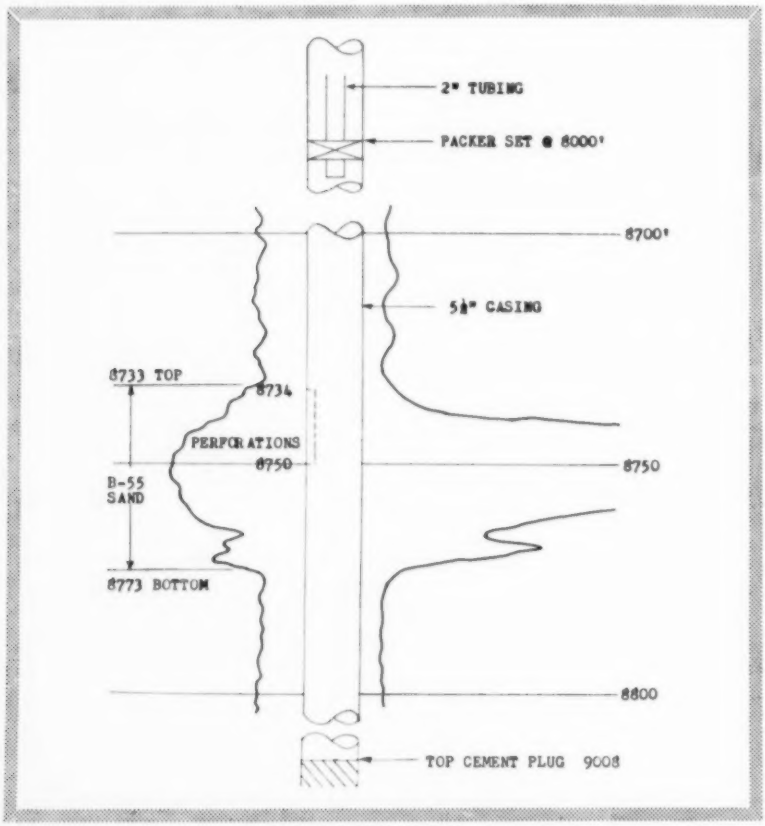

FIG. 4. **Present mechanical condition** of the Buras No. 55 completion. Well is perforated near the top of the B-55 zone at an interval at 8734-50 ft.

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1. Morrow, R. W.: "Updip Oil Recovery by Downdip Gas Injection," *The Petroleum Engineer*, April, 1957.

Acknowledgment

The authors wish to express their appreciation to Tidewater Oil Company for permission to publish this article.

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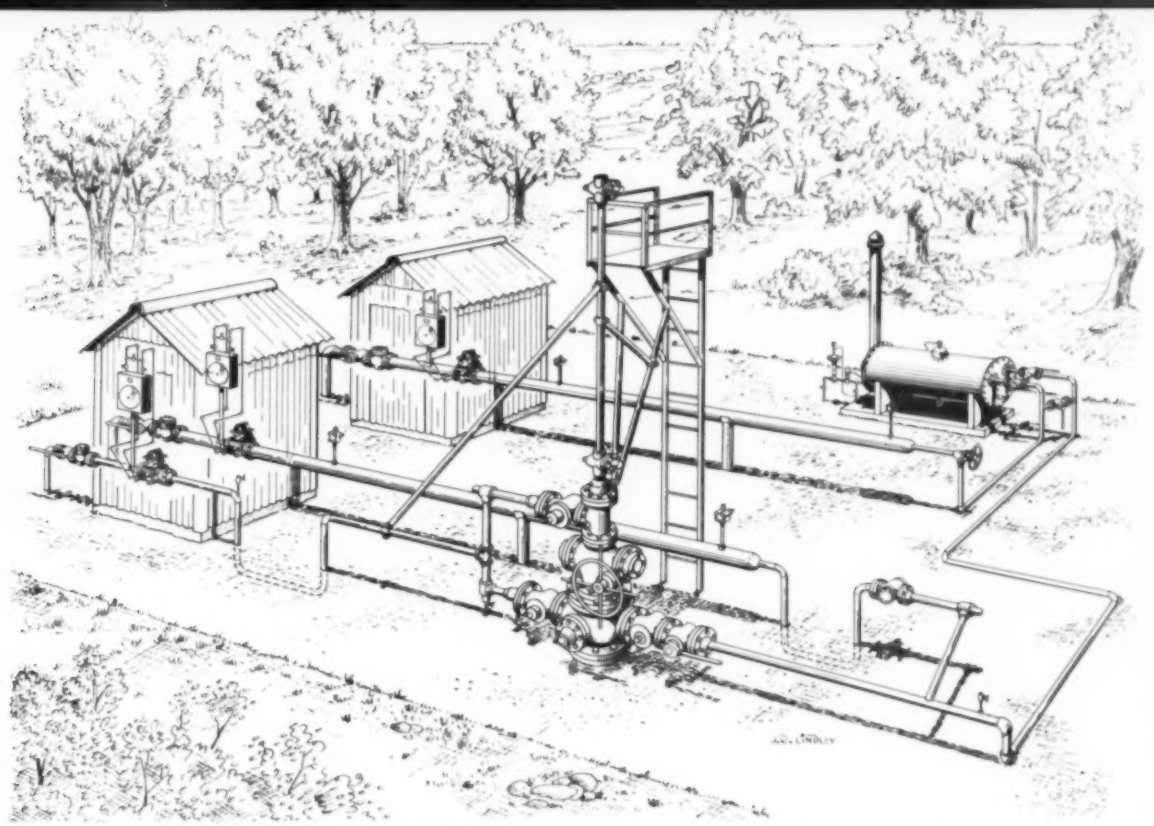

FIG. 1. **Wellhead fittings and orifice meter runs** used in gas-well capacity tests. One meter run was used to measure the flow of gas through the tubing and the other to measure flow of gas through the casing. Hydrate formation during initial flow from the well was prevented by flowing gas through a heater.

Various methods used in comparison of . . .

P 458.12

Productivity Tests On a Large-Capacity Gas Well

Theoretical prediction of gas well stabilization usually requires reservoir data not always available. Here is a study of a series of tests which includes

- **Conventional back-pressure tests of increasing and decreasing-rate sequence**
- **Isochronal performance tests of increasing-rate sequence**
- **Extended period flow tests**

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THE CONVENTIONAL BACK-PRESSURE TEST[1] and more recently the isochronal performance test[2] have been used to determine capabilities of gas wells for delivering gas under various conditions. These tests are generally accepted and have proved their merit through the years. However, the use of such test results is limited because reservoir conditions during reasonable test periods often differ from conditions after extended production. Although considerable advances have been made, the theoretical prediction[3] of gas well stabilization requires simplifying assumptions and reservoir data that usually are not available.

Extended Flow Test

A practical solution to this problem has been suggested by the Industry Committee of the Kansas Corporation Commission.[4] **In this method, the slope of the back-pressure curve is determined by a conventional multipoint back-pressure test. Then, the location of a curve of this slope is determined by an extended flow test.**

The slopes of a series of isochronal curves determined for a given well are relatively independent of the flow periods. Hence, a more precise but often more tedious method would involve the use of an isochronal test to determine the slope of the curve and then an extended flow test to establish its location. This modification of the Kansas method recently was suggested by Walker and Dunning.[5]

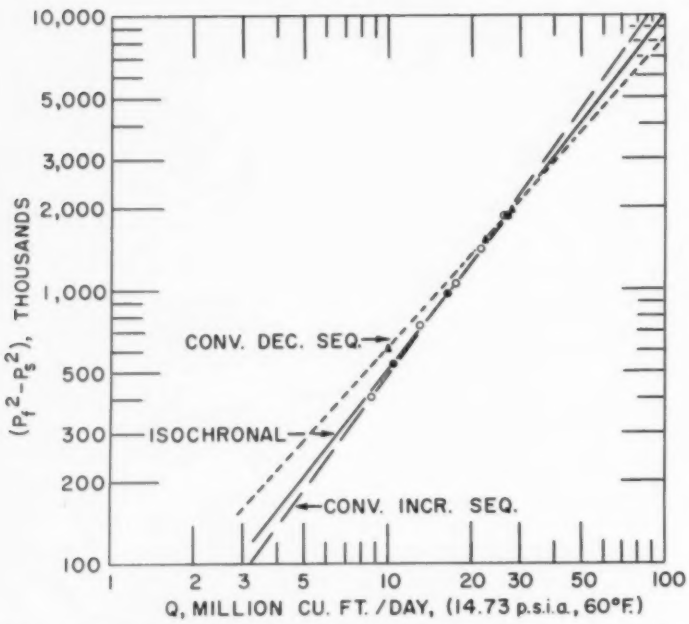

FIG. 2. **Comparison of results** of isochronal performance test and of increasing-rate and decreasing-rate sequence conventional back-pressure tests. Note close agreement of increasing-rate sequence and isochronal tests.

Such tests often are adequate for predicting the behavior of shallow or low-pressure wells. However, in deeper, high-pressure wells, tests often give results that deviate considerably from actual behavior. Accordingly, a large-capacity well of the Lone Star Gas Company in the Opelika field, Henderson County, Texas, was selected for a series of tests which included conventional (flow-after-flow) back-pressure tests of increasing and decreasing-rate sequence, isochronal performance tests of increasing-rate sequence, an extended period flow test, and pressure-buildup and drawdown tests.

Test Procedures

The well was dually completed using 6.214-in. ID casing and 2.875-in. OD tubing. Flow through the annulus is from the Rodessa formation while flow from the tubing is from the Travis Peak formation. The productivity tests were based on flow from the Rodessa formation which is productive from two intervals, 8066 to 8078 ft and 8142 to 8174 ft. The casing from the upper Rodessa productive zone was perforated with 56 of 9/16-in. shots and the lower zone was perforated with 147 of 9/16-in. shots. A liner was hung below the Rodessa formation and extended through the Travis Peak formation with a packer set at 8870 ft.

The bottom-hole shut-in pressure of the Rodessa formation was about 2615 psia and the bottom-hole temperature was 240 F. The bottom-hole shut-in temperature was obtained by a series of temperature surveys made with bottom-hole instruments. The average specific gravity of the gas produced from the Rodessa formation was 0.640. Calculations based on pressure drawdown tests show that the permeability of the formation was about 400 md.

The conventional back-pressure tests were made by procedures outlined by Rawlins and Schellhardt[1]; the isochronal performance tests were made by the methods of Cullender.[2] Bottom-hole pressures were calculated by the recently developed method of Cullender and Smith.[6]

Flow rate measurement. The tests were made during withdrawal operations with a relatively constant reservoir pressure. Each flow rate of the conventional back-pressure test was maintained for two hours. The two-hour flow periods of the back-pressure tests were chosen because this period appeared sufficient for adequate flow stabilization. During the isochronal performance test, the well was allowed to flow for two hours and shut-in one hour between each flow-period. The well was opened to flow for 27 hours during an extended flow test to determine well stabilization. Wellhead pressures were measured with dead-weight gages at half-hour intervals and at the end of each period. The well was equipped with two orifice-meter runs, one to measure the flow of gas through the tubing and one to measure the flow of gas through the casing.

Hydrate formation during the critical period of initial flow from the well was prevented by flowing the gas through a heater. The heater was bypassed after the cooling effect of the expansion of the initial produced gas ceased. At the end of each back-pressure test, the well was shut in overnight to permit pressure stabilization before the test of the succeeding day.

Friction factors. The friction factors recommended for use in Cullender and Smith's equations are based on an absolute roughness of 0.0006 in. The friction factors or F_c values used in the above-mentioned equations for this paper were calculated using an equation from the Kansas Gas-Well Testing Manual[4] for annular flow through various casing-tubing combinations. The equation, for values of F_c less than 1.311, is:

$$F_c \text{ (for annulus)} = \left[\frac{0.10337}{(d_1+d_2)(d_1-d_2)^{1.582}}\right]\left[\frac{P_b}{14.65}\right]_{T_eZ_e}$$

where F_c = friction factor
d_1 = internal diameter of casing, in.
d_2 = external diameter of tubing, in.
P_b = pressure base, psia
T_e = effective temperature, deg Rankine
Z_e = effective compressibility factor.

All compressibility values were taken from tables in the Kansas Gas-Well Testing Manual.[4]

Deliverability. A measurement of deliverability, called the "Q_{1000}" value, has been used as a replacement for the "open flow" and "C" values that have been used previously. The Q_{1000} value is defined as the rate of flow of gas from a well when $(P_c^2-P_w^2)$ or $(P_f^2-P_s^2)$ in the back-pressure equation, $^1Q=C(P_c^2-P_w^2)^n$, is equal to 1,000,000. This measure has been discussed previously by Walker and others.[7]

Results and Discussion

The results of the isochronal performance test and of increasing-rate and decreasing-rate sequence conventional back-pressure tests are shown in Fig. 2. The increasing-rate sequence and isochronal tests give essentially the same results. This correlation commonly is observed in formations of high permeability and has been discussed previously.[2,7] As observed by Binckley,[8] and Cullender,[2] the decreasing-rate sequence back-pressure test indicates a larger "n" value and its use would result in an abnormally large calculated open-flow potential.

These and other test results are summarized in Table 1. The standard deviation factor, S_f, was introduced recently as a statistical measure of the fit of the points to a straight line.[9] A "perfect" fit is indicated by a value of 1.00 and values below about 1.07 indicate data that will plot as an essentially straight line.

Comparisons. In a flow-after-flow test, the first point determined should fall on the isochronal curve but each succeeding point is increasingly affected by the increasing radius of drainage. Therefore, the conventional flow-after-flow test results deviate from the isochronal results in opposite directions. The deviation is larger in the decreasing-rate sequence test because the largest drainage radius (resulting from three flow tests) is imposed during the lowest flow rate. This is borne out by the data in Table 1 wherein the "n" and "C" values for the isochronal performance test are shown to be 0.77 and 420; the corresponding values for the conventional increasing-rate sequence test, 0.73 and 730; and those for the conventional decreasing-rate sequence test are 0.88 and 80. Similar observations were made by Cullender with wells of lower capacity.[2]

Back-pressure curves based on bottom-hole conditions often are required for accurate calculations of reservoir capability and effectiveness of well-completion methods. Curves based on wellhead conditions show well capabilities, as completed, and reflect the effects of the gas column and friction in the flowstring.

TABLE 1. Comparison of Results from Various Test Methods.
(Period of flow, 2 hours; bottom-hole conditions unless indicated otherwise; pressures calculated by method of Cullender and Smith.[5])

Method	n[a]	C[b]	Q_{1000}[c]	Sf[d]
Isochronal performance				
Increasing sequence	0.77	420	16.9	1.01
Conventional back-pressure				
Increasing sequence				
Bottom-hole	.73	730	16.7	1.02
Wellhead, measured	.71	1,130	20.4	1.03
Wellhead, equivalent	.74	770	22.5	1.03
Decreasing sequence	.88	80	15.4	1.03
"Stabilized" performance	.77[e]	490	15.6	—

[a]Based on back-pressure equation: $Q = (P_f^2 - P_s^2)^n$.
[b]Cubic feet per day when $(P_f^2 - P_s^2) = 1$.
[c]Million cu ft per day when $(P_c^2 - P_w^2) = 1{,}000{,}000$.
[d]A measure of the fit of the straight line drawn through the points.[9]
[e]Calculated by method of Walker and Dunning.[6]

In low-pressure, shallow wells, the extensive calculations necessary to convert to bottom-hole conditions often are unnecessary.[5,7] However, such corrections would be expected to become more important with increasing pressure and flow rates. This well was selected primarily because of its known high deliverability — about 28 million cu ft per day for extended periods into a pipeline with a working pressure of about 800 psi.

The results of back-pressure curves calculated from bottom-hole, flowing wellhead, and equivalent[4] wellhead data are compared in Table 1. The wellhead curves are displaced farther away from the pressure axis than the bottom-hole curve. The difference in position of the bottom-hole curve with respect to the wellhead curves probably is due to the mathematical relationship of the differences in the squares of sets of larger numbers (bottom-hole pressures) compared to sets of smaller numbers (wellhead pressures) at the same flow rates. This relationship was noted to a lesser extent for the wells of the comparatively low-pressure, shallow Ulan storage as reported by Walker and others.[7]

Despite the high flow rates, high temperature, and relatively high pressure, the slope of the wellhead curve is essentially the same as the slope of the bottom-hole curve indicating that friction effects in the annulus were not unduly large. Furthermore, by a recently described statistical test,[9] there is no indication of deviation from linearity. This is illustrated in Fig. 3. The equivalent wellhead back-pressure curve is based on calculated wellhead pressures excluding the frictional effects of flow through the producing string. This is the method recommended by the Industry Committee of the Kansas Corporation Commission.[4]

The difference between the equivalent wellhead pressure and the bottom-hole pressure is that due to the weight of the gas column. If such a test is to be used to establish the typical slope for a well and be supplemented by an extended period flow test, as in the Kansas method,[4] wellhead data may prove satisfactory. The wellhead curve is, however, much further displaced from the bottom-hole curve than are curves of shallow or low-pressure wells. The Q_{1000} value determined from the wellhead curve is 20.4 million cu ft per day compared to 16.7 million cu ft per day for the bottom-hole curve, a difference of 22 percent. The Q_{1000} values determined from the wellhead curves of two gas-storage projects having pressures from 200 to 600 psia differed from the corresponding values determined from bottom-hole curves from about 1 to 8 percent.

An extended-period flow test was

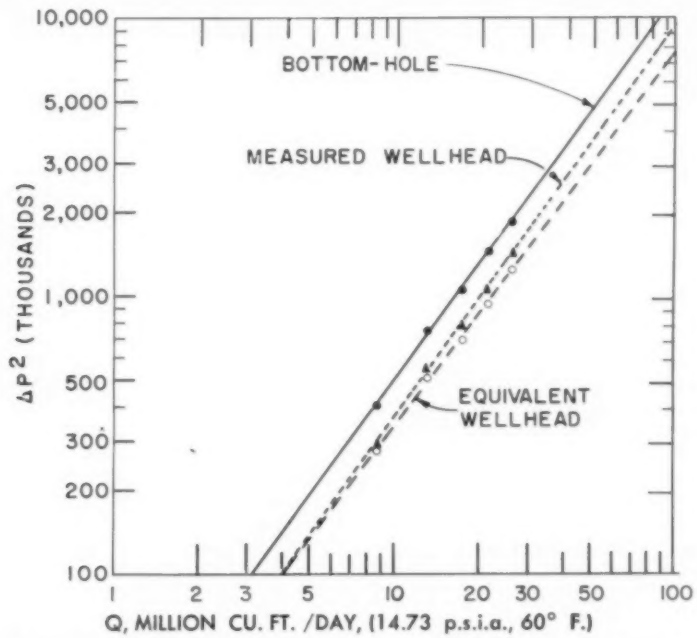

FIG. 3. **Comparison of back-pressure curves** shows frictional effects. Slope of the wellhead curve is essentially the same as the slope of the bottom-hole curve, indicating relatively minor friction effects in the annulus. Equivalent wellhead curve is based on calculated pressures excluding frictional effects of flow through the producing string.

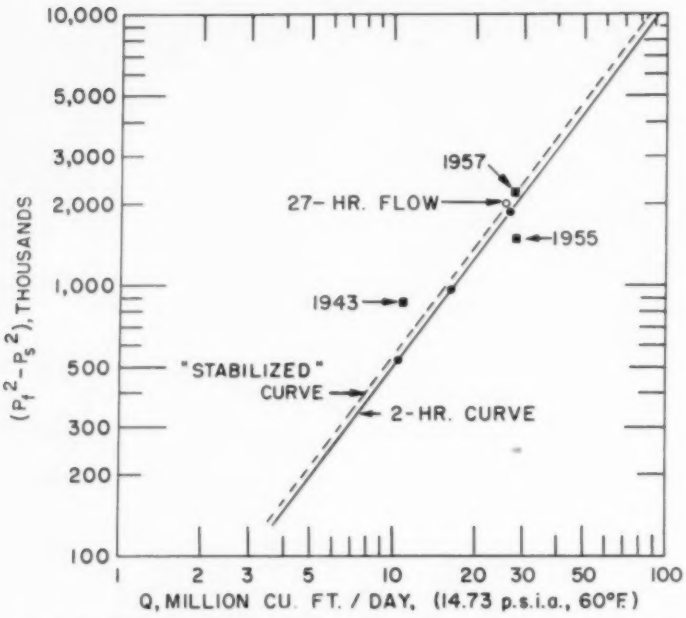

FIG. 4. **Comparison of actual production history** of the well with its stabilized performance curve. Results indicate that a stabilized performance curve provides an approximation of well capacity under normal extended-withdrawal operations.

made to study the stabilization characteristics of the well. This test consisted of a record of working pressure and flow rate with time until both reached an acceptable degree of stabilization. The data from this test were used to establish a point through which was drawn a line having the slope (0.77) previously determined from the isochronal performance test as shown in Fig. 4. This curve represents the "stabilized" isochronal performance curve of the well.

The well stabilized rapidly as observed by the comparison of the 2-hour isochronal curve to the stabilized performance point. For practical purposes the well could be considered stabilized at a given flow rate after 2 hours. The deviation of the Q_{1000} value of the 2-hour isochronal curve from that of the stabilized performance curve is about 8 percent.

Production history. A comparison of the actual production history of this well, with its stabilized performance curve, also appears in Fig. 4. Because the shut-in pressures were measured directly on this well rather than on an observation well, few applicable data were available. They are, for the same reason, probably more trustworthy. It is observed that the data points fall acceptably close to the test curve. **These results indicate that a stabilized performance curve developed in the manner above provides a reasonable approximation of the capacity of the well under normal extended-withdrawal operations.**

Conclusions

Various methods have been used in testing a relatively deep, high temperature, large capacity gas well. This well is in a highly permeable formation and stabilized rapidly. Therefore, the isochronal performance and conventional increasing-rate sequence back-pressure methods give essentially the same results. Furthermore, the "stabilized 27-hour performance" curve is displaced only a small amount from the test curves obtained after 2-hour periods of flow.

The decreasing-rate sequence test resulted in a back-pressure curve having a high "n" value. The use of such a curve would result in unreasonably high open-flow potential predictions.

Actual "production points," plotted from field records, fall acceptably close to the test results obtained by the isochronal performance method and the increasing-rate sequence conventional method. These results indicate that these methods are adequate for prediction of gas well capability in formations of high permeability. The effects of friction and high bottom-hole temperature were amenable to treatment by the most recent methods of calculating bottom-hole pressures.

Acknowledgment

This work was done in cooperation with the American Gas Association. Advice and assistance of the Supervising Committees, A.G.A. Project NC-3 and NC-8, are gratefully acknowledged. The authors are particularly appreciative of the cooperation of W. F. Burke and other members of the staff of the Lone Star Gas Company and acknowledge the assistance of Henry Hackmuth and Wayne Schmidt.

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Scientists Investigate Unique Venezuelan Oil Discovery

A party of scientists from three affiliates of Standard Oil Company (New Jersey) has begun an intensive examination of a remarkable oil deposit in the delta of the Orinoco River in eastern Venezuela.

The oil is a mere 5000 to 10,000 years old, which means that it is still in the embryonic stages of its development. Oil produced from the average commercial well is generally in excess of 10 million years old.

This discovery, according to Jersey Standard, has provided the first opportunity to observe nature in the act of creating an oil reservoir. The presence of oil-like hydrocarbons in sediments has been noted before, but this is the only case known in which hydrocarbons have actually begun to collect in a stratigraphic trap.

Investigation of the embryonic oil is being conducted jointly by the Jersey Production Research Company, of Tulsa, Oklahoma, and Esso Research and Engineering Company, of Linden, New Jersey—scientific affiliates which carry out research activities on behalf of all companies associated with Jersey Standard—and by Creole Petroleum Corporation, Jersey's Venezuelan affiliate.

Past, present, and future developments in . . .

OIL RECOVERY BY THERMAL METHODS

Part 1

Over two-thirds of the crude oil discovered in the United States is classified as unrecoverable by present producing methods. However, developments in thermal recovery methods promise that much of this oil will be produced economically. Three such methods are

- ★ **Oil well heating**
- ★ **Hot fluid injection**
- ★ **In-situ combustion**

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THE TOTAL AMOUNT OF CRUDE OIL that has been discovered in the United States has been reported to be in excess of 270 billion bbl.[1] Of this amount 57.6 billion bbl have been produced through 1957, and 30.3 billion bbl are listed officially by the American Petroleum Institute as the crude oil reserves that are economically recoverable by present known techniques.[2] This leaves the staggering total of over 180 billion bbl of crude oil that has already been found but that must be classified as unrecoverable for lack of a practical and efficient producing method.

Until recent years, only a moderate amount of attention was given to the development and application of new oil recovery processes because discovery rates for new reserves were sufficiently high to provide an adequate supply of crude oil. Now with discovery rates dropping steadily, and demand for crude oil continuing to grow, it seems almost an understatement to say that the greatest need for the U. S. petroleum industry today is for methods to produce the large reserves of so-called "unrecoverable" oil whose location is already known. There are few if any engineering challenges in all of industry that match this one either in complexity of the problem or in potential benefits to be obtained from its successful solution.

In order to understand the progress that has been made in this field to date, and the aspects of it that hold most promise for the future, it is helpful to keep in mind some of the technical factors that control oil recovery efficiency.* While there are many such factors, the two primary ones are permeability of the reservoir rock and nature of the displacement mechanism. Fracturing and acidizing are examples of operating techniques that have been moderately successful in increasing the effective permeability of the reservoir rock around the well bore, thereby improving productive capacity of the wells so treated. Waterflooding and gas repressuring are now well established reservoir processes for increasing oil recovery by supplying a supplemental displacement process to the entire reservoir.

In this latter category, two new methods — miscible flooding and thermal recovery — are now in the early stages of development and application. Both of these methods hold promise of greater potential benefit than previous methods in that displacement in the swept regions of the reservoir approaches 100 percent effectiveness. It is the purpose of this discussion to review the present status and future possibilities of one of these new methods —namely, thermal recovery.

General Application of Thermal Methods

Thermal methods have their most effective application in the recovery of low gravity crude oils.[3] This is illustrated in Fig. 1 which is based on laboratory flow data and viscosity-temperature relationships for a 13 deg API crude oil as compared to a 32 deg API crude oil. **The markedly greater effect of temperature on the viscosity and displacement efficiency of lower gravity crude oil demonstrates an inherent feature of thermal methods that makes them unique among oil recovery processes. In fact, they are the only presently known recovery methods that can be applied effectively in many reservoirs.**

Presented before the Interstate Oil Compact Commission at Kansas City, Missouri, December 1, 1958.

*The term "Oil recovery efficiency" implies both rate and ultimate amount of oil recovery.

Note: This article will be published in two installments. This, the first, is devoted to oil well heating and hot fluid injection. The second installment, dealing with in-situ combustion, will be published in the March 1959 issue of THE PETROLEUM ENGINEER.

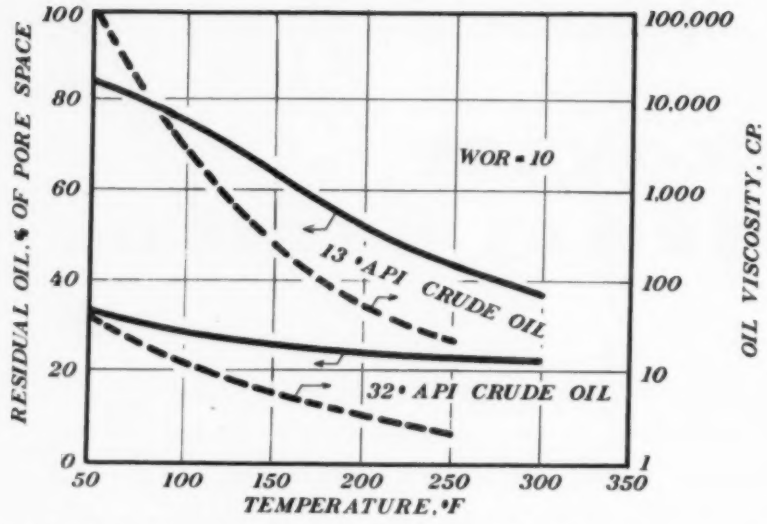

FIG. 1. **Effect of temperature** on viscosity and displacement of oil by water.

Heavy oil reservoirs are known to exist in all parts of the United States. Although the greatest concentration of such reservoirs appears to be in California and the Rocky Mountain areas, there are a large number of them in the Mid-Continent as well, so that the application of thermal methods should be of general interest to oil operators everywhere. This is particularly true in light of the widespread occurrence of very heavy oil deposits, often referred to as tar sands, which are not even listed in many industry reserves records because they have never been considered to be of commercial significance. Thermal methods hold real promise of bringing such deposits into the commercial oil production picture in the future.

Heavy oil reservoirs are usually characterized by shallow depth, poorly consolidated sand, high oil saturation, and low gas saturation. It will be helpful to keep these general characteristics in mind in the ensuing discussion of the application of thermal methods, which has been organized under three principal headings as follows:

1. **Oil Well Heating**
2. **Hot Fluid Injection**
3. **In-Situ Combustion**

It should not be construed that thermal methods are specifically limited to heavy oil recovery operations. A number of the thermal methods involve important drive mechanisms in addition to simply supplying heat to the reservoir, and these mechanisms can be very effective in the production of higher gravity crude oils. However, this area of application for thermal methods has not been very extensively developed to date because other oil recovery processes are being used effectively already in connection with higher gravity crude oil reservoirs. An exception to this statement is found in certain well heating applications involving high gravity crudes which tend to deposit solid or semi-solid hydrocarbons (paraffin) on production.

OIL WELL HEATING

The heating of production wells to improve rate of recovery, and usually ultimate recovery, by extending the economic life of an oil field, represents to our knowledge the oldest known application of thermal energy to oil reservoirs. The first published item dealing with this subject is found in the patent literature which indicates that on July 4, 1865, U. S. Patent No. 48,584, describing an electrical oil well heater, was issued to George T. Perry and William S. Warner. Since that time more than 100 patents have been issued, relating to various aspects of well heating.

An example of one such patent referred to in the early technical literature[4] was issued to Snelling in 1914. It describes a method of treating oil wells by "... generating a large volume of highly heated gas in them by the combustion of a relatively slow-burning explosive such as gunpowder, nitrocellulose, or thermite so that the pressure of the gases will cause them to penetrate the formation adjacent to the well and melt out paraffin or other obstructing substances." Ten years later Mills[5] described in the *National Petroleum News* the use of electrical heaters, hot water, steam, and downhole combustion for removal of paraffin deposits in oil wells, and in 1925 the Hope Gas Company announced a method whereby 200 cu ft of natural gas and 3000 cu ft of air were supplied to a burner at the bottom of a well and temperatures of 2300 F to 2700 F were attained.[6]

Only in recent years[7] has it been recognized that wells free of paraffin problems could be profitably stimulated by heating, presumably by the mechanism of viscosity reduction of crude oil in the formation surrounding the well bore. That appreciable quantities of heat may penetrate into a formation counter-current to the flow of produced fluid can be shown by application of the basic principles of heat transfer.

The net effect of conduction of heat into a formation and the "convection" of heat back to the well bore by movement of produced fluid, is illustrated in Fig. 2. The temperature-distribution data during the unsteady-state period (top section of Fig. 2) were calculated using an electronic digital computer; the temperature-distribution data under steady-state conditions (bottom section of Fig. 2) were obtained by a method similar to that presented by Melby[7] and later by Schild.[8] These data illustrate clearly that (1) a relatively long period of time is required for the temperature distribution in the formation to reach equilibrium at constant production rate, and (2) production rate has a marked effect on the temperature distribution in the formation.

Production increase, the effect in which we are most interested, can now be investigated. With information on temperature distribution, and with temperature-viscosity data for a specific crude oil, Darcy's law of flow can be applied to establish the reservoir conditions (pressure drawdown and permeability) required for a production rate for the heated well of, say, 15 bbl of oil per day under steady-state conditions.* The production rate before heating can then be calculated, assum-

*The relationship, an integrated form of Darcy's law for radial flow conditions, is:

$$hK\,(P_e - P_w) = Q_o\rho_o \int_{r_w}^{r_e} \frac{\mu}{\rho}\, d\ln r \qquad (1)$$

where

h = formation thickness
K = effective permeability to oil
P_e = pressure at drainage radius
P_w = producing bottom-hole pressure
Q_o = oil production rate, original reservoir bbl per day
ρ_o = crude oil density at original reservoir conditions
$\frac{\mu}{\rho}$ = kinematic viscosity of crude oil at radial distance, r, from well bore
r_e = drainage radius (250 ft)
r_w = well radius (3 in.)

The above radial flow equation reduces, for conditions before heating, to:

$$2\pi hK\,(P_e - P_w) = Q_o\rho_o \int_{r_w}^{r_e} \frac{\mu_o}{\rho_o}\, d\ln r$$

$$= Q_o\mu_o \ln(r_e/r_w) \quad . \quad . \quad . \quad . \qquad (2)$$

where μ_o = absolute viscosity of crude oil at reservoir temperatures.

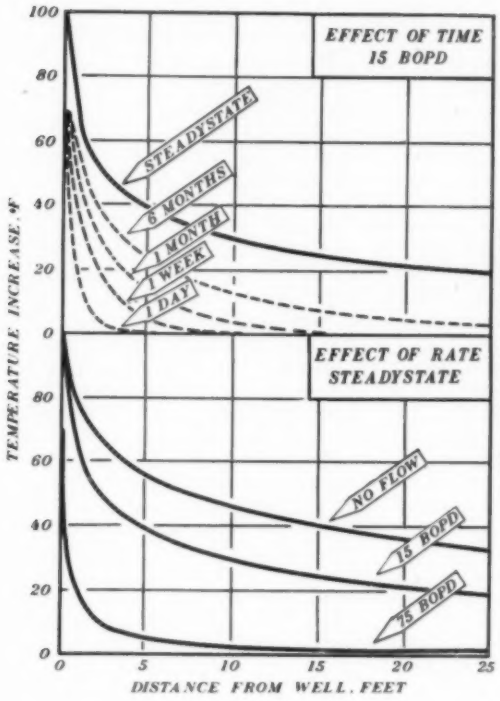

FIG. 2. **Radial temperature distribution** resulting from well heating. Assumed conditions: Crude oil gravity — 30 deg API; Crude oil heat capacity — 0.43 Btu per lb-deg F; Formation thickness — 50 ft; Formation thermal conductivity — 1.5 Btu per hr-deg F-ft; Formation density — 120 lb per cu ft; Formation heat capacity — 0.27 Btu-lb-deg F; Well bore diameter — 6 in.; Vertical heat losses neglected.

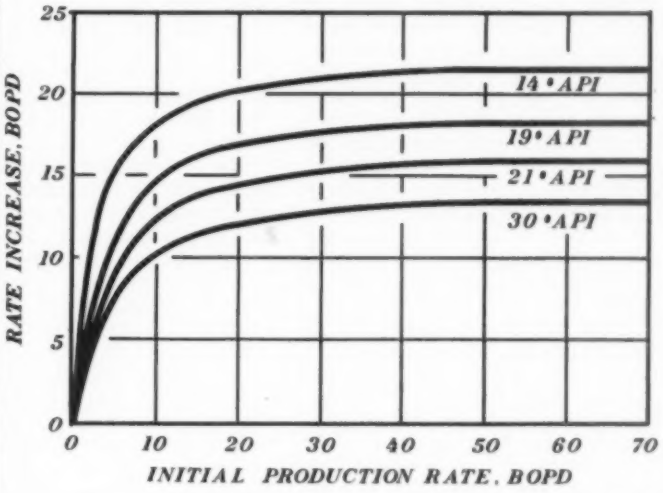

FIG. 3. **Production rate increase** by well heating for oils of varying physical characteristics.

ing no change in permeability or pressure drawdown.

Fig. 3 presents data calculated in this manner for rate increase due to viscosity reduction for several crude oils with different viscosity-temperature characteristics.** It was assumed in each case that the original temperature was 100 F and that the well bore was heated to 210 F.

The absolute values of Fig. 3 should not be considered applicable to a specific field case, because many factors other than viscosity reduction are involved and because heated reservoirs may not attain a stabilized temperature distribution for many years. However, the qualitative trends are noteworthy implying as they do two important criteria for selection of wells with maximum potential response to heating (in the absence of paraffin): (1) low initial production rate, and (2) high oil viscosity (low API gravity).

Equipment

Two general classes of heating equipment have been in general use during recent years. These are electrical and fluid-circulating types. Some of the comparative costs of oil well heaters available from different manufacturers are listed in Table 1. Ratings of all heaters are expressed in kilowatts deliverable at the surface, to permit direct comparison between the circulating and electrical resistance heaters. Daily energy costs are based on unit costs of 1.0 cent per kwhr for electricity, $3 per bbl for heating oil, and 20 cents per Mcf for 1000 Btu natural gas. Note that both purchase prices and cost of energy delivered at the heater are much higher for electrical than for fluid circulating heaters. However, fluid circulating heaters possess the obvious disadvantage that a very high percentage of the heat delivered by a fluid circulating heater may be lost in transit to the formation above the pay sand.

Walker[9] has suggested a "break-even" depth for equal *delivered* energy costs using either type of heater to be about 2000 ft for the Yorba Linda field in California. For greater depths the increased heat losses apparently more than offset the lower energy cost associated with the circulating type of heater.

Other means of generating heat

TABLE 1. Commercial Bottom-Hole Heaters.

Type	Manufacturer	Nominal Rating, KW	Approx. Cost, $	Approx. Daily Energy Cost, $[1]
Electrical	A	7.5	900	1.80
		10.5	1250	2.50
		15	1550	3.60
		21	2000	5.00
		35	2250	8.40
		50	2500	12.00
		90	3250	21.60
		135	4400	32.40
	B	18	2250	4.30
		30	2500	7.20
	C	10	875	2.40
		15	925	3.60
		30	1975	7.20
Fluid Circulating	D	60	1695	3.30
	E	90	1595	1.80
		160	2440	3.20
	F	90	1350	5.00
		640	4200	35.00

(1) Basis for calculating operating costs:
Electrical heaters — 1¢/KWH for electricity
Fluid circulating heaters — 20¢/Mcf for gas
$3/bbl for crude as heating oil
80% thermal efficiency

**The four selected crude oils had the following viscosities:

Crude Oil Gravity, °API	Viscosity, Centipoises at 100 F	at 210 F
14	2490	71
19	386	27
21	133	16.3
30	32.2	6.2

downhole include those which involve exothermic chemical reactions. The use of calcium carbide and the combination of caustic soda with aluminum, represent typical methods of generating sufficient thermal energy, for short periods of time, to permit removal of paraffin obstructions in the well and on the sand face. Downhole gas burners also utilize the principle of exothermic chemical action to provide continuous heating but only in recent months has a commercial model become available.

Economics

Reliable techniques for predicting the response of an oil well to heating do not yet exist. However, operating costs have been reasonably well established for specific field installations, and the money-making potential of well heating has been clearly demonstrated in a number of cases. In California, at Yorba Linda, South Belridge, Placerita, and other heavy oil areas, operators have developed a considerable backlog of experience. And the Cut Bank field of Northern Montana represents one of the more recent field-wide applications to a probable paraffin plugging condition.

Fig. 4 illustrates the success of one operator[10] in the Cut Bank field. Electrical heaters (5-kw) positioned opposite the pay were found almost to double production rate (average increase from 8.5 to 15.7 bbl of oil per day for 26 installations). Furthermore, it was later observed that the increased rates could be sustained with intermittent heating.[11]

TABLE 2. Effect of Well Heating on Production Rate in One Heavy-Oil Field in California.

No. Wells	Initial Rate, BOPD Range	Initial Rate, BOPD Average	Average Rate Increase, BOPD	Average % Increase
2	2 - 4.9	3.5	6.5	186
6	5 - 9.9	7.4	8.4	113
5	10 - 14.9	13.3	8.0	60
8	15 - 19.9	16.5	9.4	57
5	20 - 27	23.5	13.5	57

In California, the effects of production well heating have been found difficult to predict. The experiences of our West Coast affiliate are noteworthy in this regard. Of 57 installations in one field since 1955, appreciable rate increases (greater than 2 bbl of oil per day) were observed in 29. Three of the 57 wells showed unusually high response to heating (2 to 12, 2 to 17, and 6 to 40 bbl of oil per day), presumably because of alleviation of a formation plugging condition. Table 2 shows the average response to sustained heating for the remaining 26 wells grouped in different production-rate brackets.

While such factors as depth, sand thickness, and water cut were quite variable, most of the wells were producing crude oils in the 12 to 15 deg API gravity range, and a statistical grouping of the data showed the same general relationship between production-rate increase and initial production as that predicted earlier on a purely theoretical basis for the effect of viscosity reduction alone.

In Fig. 5 these average responses are compared with those predicted for a 13 deg API California crude oil by the method described earlier and illustrated in Fig. 3. In this case, however, the formation temperature was taken as 80 F (at which temperature, the oil viscosity was 3500 cp), and the well bore temperature was taken as 140 F (corresponding to a viscosity of 210 cp). This temperature was measured in one of the field wells.

The predicted response is shown to depend strongly on net sand thickness. This is because the movement of heat back into the producing formation depends upon the average *specific* productivity of the sand (bbl of oil per day per ft of sand thickness) rather than the overall rate of production. Thus, a well producing at a given rate from a thin sand would be expected to show less response to heating than a well maintained at the same temperature and producing at the same rate from a thicker sand zone.

Net sand thickness for the 26 wells listed in Table 2 averaged some 120 ft as determined from electric logs. However, the length of the heater used in these wells was only 40 ft, so that the net effective thickness of sand being heated was actually 40 ft or less. The field performance tends to bear this

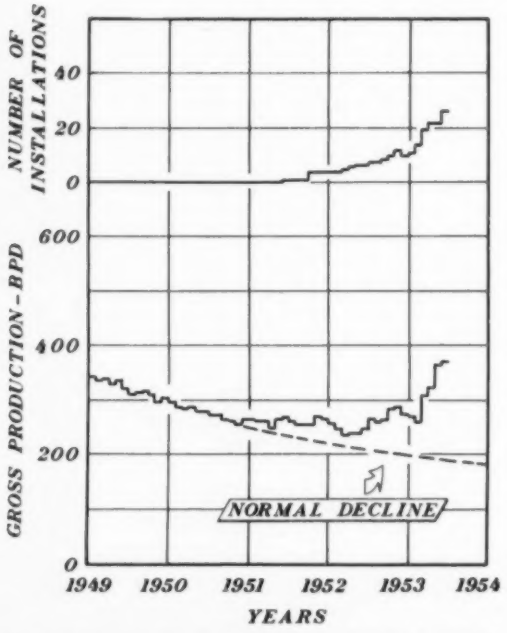

FIG. 4. **Production performance** by well heating in the Cut Bank field of Northern Montana.

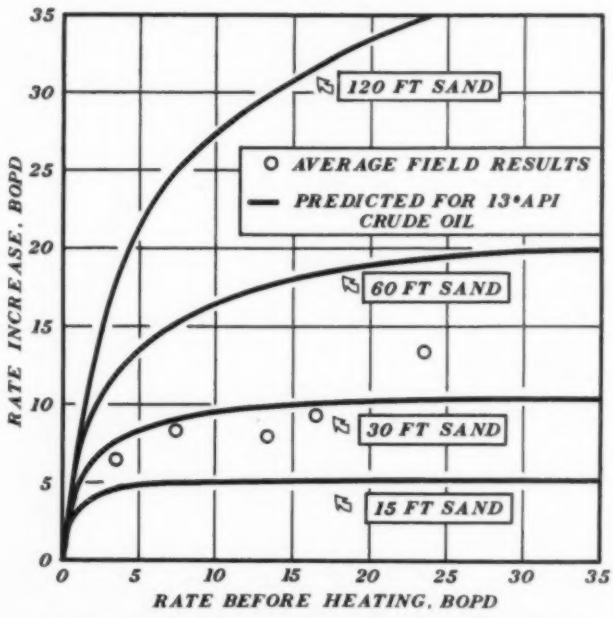

FIG. 5. **Production rate increase** by well heating in a California field.

out in that agreement between observed and calculated performance is only obtained by assuming that production was coming from about a 30-ft sand interval as shown in Fig. 5.

An economic analysis of data collected on all 57 installations discussed above showed that the investment for these installations paid itself out in about two years. However, inability to predict response for specific well heating applications, as in the field discussed, where fewer than half the installations were profitable, has a marked detrimental effect on the money-making potential of this application of thermal energy.

Our cost experience in California leads to the general "rule of thumb" that in order to obtain a two-year payout on costs and operating expenses, it is necessary for heating to increase production rate between 3 and 4 bbl of oil per day per well. Stormont[12] in an excellent review of bottom-hole heating in California heavy-oil fields (Yorba Linda, Cimric, Placerita, and Midway-Sunset) states that "an increase of approximately 5 bbl of oil per day is needed for the average installation to be economical."

HOT FLUID INJECTION

A method of thermal recovery more closely akin to conventional techniques than others that will be discussed is the direct injection of a hot fluid (water, gas, or steam) with the objective of taking advantage of effects illustrated in Fig. 1. The improved efficiency in displacement of oil by water that can be brought about by an elevation of temperature is clearly indicated. Displacement by steam is another matter, however, and the effects of repeated condensation and vaporization that may occur at a high temperature steam front have not been clarified.

Review of Field Applications

The idea of flooding with heated water has been with us almost as long as conventional waterflooding, but useful field information has not yet been made available to the general public.

Documented field applications on the use of steam or hot injection water include those of Barton[17] of Forest Oil Company, Stovall[18] of Houston Oil Company, and Breston and Pearman for the Penn Grade Crude Association.[17] A case of steam injection in a shallow sand of the Bellevue Pool, Louisiana, in 1936, was mentioned by Tucker,[19] who also stated that steam injection had been tried many times before this date. More recently, at least three operators are known to have field tested steam injection as a recovery technique but information has not been released on the results of these experiments.

Barton's work was initiated not for the purpose of increasing production but in an effort to improve injectivity of water into tight Bradford sands. Using external gas burners under the water line going to an injection well, he was able to heat injected water to a temperature so high "that the straw in the water box which came into contact with the pipe caught on fire." Injection rates into the Bradford sand of several times the rate before heating were said to be attained, and on cessation of heating, rates remained 100 percent greater than before heating.

Breston and Pearman reported much less improvement of injectivity (a maximum increase of 35 percent) with a 24-kw electric heater positioned opposite the sand face. The possibilities of hot waterflooding for the purpose of improving injectivity were recently revived by the proposal of James A. Lewis Engineering to use warm injection water in a Pembina field waterflood.[20]

Stovall's work in West Texas represents the only successful steam injection test reported in detail. Starting in 1931, an inverted 9-spot steam-injection test was carried out on 150-ft spacing in an 18-ft thick sand at 380 ft depth near Woodson, Texas. Steam at pressures as high as 200 psi was injected for a total of 235 days. No production increase was noted for the first 3 months, but after 5½ months of injection, production rates in pattern wells had increased 8-fold to an average of 25 bbl of oil per day, with a slight increase in water cut (from 50 to 64 percent).

For the entire test 22,000 bbl of water were injected as steam, and some 4300 bbl of oil were produced, of which 2300 bbl were used as fuel. Another 5700 bbl of oil were estimated to have been displaced from the pattern without being produced.

Economic Factors

The economics of hot water or steam drive as a recovery technique are dependent on highly specific conditions for an area of interest and we can presently deal with only the qualitative aspects of factors governing cost and recovery.

Schaller and Bjornsson in 1923[18] considered the possibilities from a theoretical approach with limited information that was available at that time on the effects of temperature. A more sophisticated approach was recently made by Van Heiningen and Schwarz[14] based on theoretical solution gas drive recoveries calculated by Muskat[15] and on linear water-drive model experiments carried out by Croes and Schwarz.[16] They concluded that solution gas drive recovery was increased less than 3½ percent by a 90 F rise in reservoir temperature, regardless of the original reservoir oil viscosity, but that water drive recovery could be increased by as much as 50 percent with the same increase in temperature for oil-water viscosity ratios as high as 500 to 1.

The amount of heat lost compared to the amount generated will undoubtedly be a major factor in a full-scale recovery program, and this depends upon depth, formation thickness, and temperature level of the injected fluids. Depth is of particular importance when heat is supplied at the surface, rather than being generated downhole by some process such as combustion or electrical resistance heating.

Our own experience with efforts to inject hot gases illustrates the very considerable energy losses that may be experienced by a fluid traveling to considerable depths before reaching the horizon of interest. The temperature profiles of Fig. 6 were obtained during

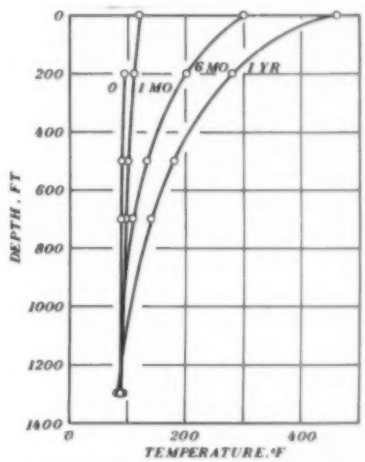

FIG. 6. **Temperature profile** during hot gas injection.

the injection of natural gas at elevated surface temperatures through insulated tubing and at rates averaging about 150 Mcf per day. The total amount of heat introduced into the hole during a one-year period amounted to some 400 million Btu. Still, the temperature of gases entering the formation after more than a year of continuous injection was, within the reproducibility of measurement, the same as had been observed when injection was initiated.

This example illustrates perhaps an extreme case, since the heat-carrying capacity (per unit volume) of a gas is much lower than for a liquid. Steam and other condensable gases present a somewhat different condition because

of the very large amount of available heat carried as heat of condensation. However, regardless of the fluid injected, losses from the well bore can be assumed to represent during the early stages of injection a major portion of the thermal energy supplied at the surface, except for applications in very shallow reservoirs.

Perhaps a more important heat loss problem, i.e., the loss to contiguous strata, occurs after the heated fluid is introduced into an oil-bearing formation. An approximate method of estimating this loss was developed by Lauwerier[21] and used by Van Heiningen and Schwarz[14] in their theoretical study of the economics of hot-water flooding. During the 37-year life of their prototype linear hot-water flood, only 22 percent of the heat introduced at the sand face was estimated to be effective for raising the temperature of the oil-bearing formation. However, the utilization of thermal energy is strongly influenced by formation thickness and duration of a flood (or rate of injection).

This can be illustrated by applying the same type of analytical techniques to compare the radial penetration of heat in a thin, tight sand (Reservoir A — 5 ft thick and water injectivity of 5 bbl per day per ft of sand) with that in a thicker, more permeable sand (Reservoir B — 20 ft thick and water injectivity of 20 bbl per day per ft of sand). Assuming all other reservoir properties are the same,* a flood front in Reservoir A would be moved 165 ft from the injection well in two years, and the same distance in Reservoir B in one-half year. A flood with 300 F water would require the utilization of 125 million Btu per acre-foot of reservoir flooded for both floods under these conditions, but the temperature distribution, as shown in Fig. 7, are widely different for the two cases. These would both have corresponded to the dashed curve in the absence of conduction heat losses.

In view of wide variability in thermal losses, the economics of hot-water flooding will not be considered in greater detail. It can be concluded, however, that thick formations permitting high water injection rates are the best prospects for this method of oil recovery.

Use of Other Fluids

Other hot fluids such as oil and noncondensable gases appear to have only limited possibilities of application. The injection of hot oil into producing formations to wash out restrictions to flow

*Porosity — 30%
Water saturation behind flood front — 80%
Volumetric heat capacity of formation — 39 Btu/ft³-F
Thermal conductivity of formation — 1.5 Btu/hr-ft-F
Temperature of formation — 100F

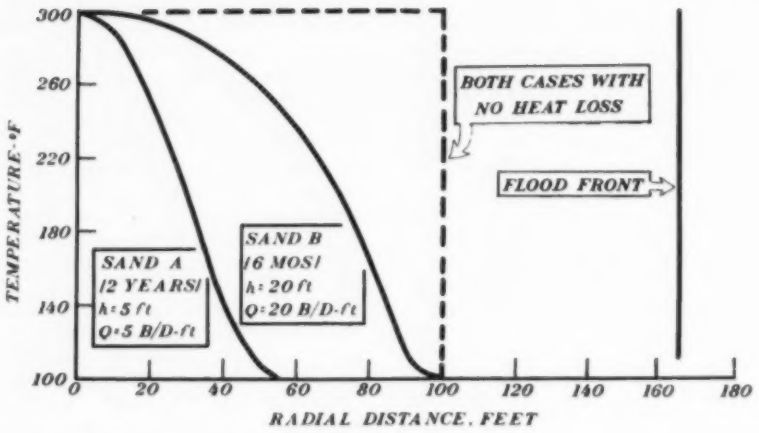

FIG. 7. **Radial temperature distribution** in a hot-water flood.

near the well bore has been a successful technique in some areas. For example, in one California field considerable success has been obtained with a technique of injecting 160 F oil (175 bbl of crude oil diluted with 25 bbl of refinery gas oil) into a 2000-ft deep zone. This zone produces a 10½ to 12 deg API crude having a reservoir viscosity of 800 to 2000 cp. Of 26 wells treated, 17 had sufficiently well established performance histories to permit evaluating the effect of treatment.

While the net effect was only that of maintaining total oil rate constant, extrapolations of the original decline rate indicated that some eight months after the first treatment, the total rate was about 300 bbl of oil per day above that expected if no stimulation had been obtained. These treatments were relatively inexpensive.

The use of non-condensable gases, heated externally or in the well bore, to provide a thermal drive, was proposed by Lindsly[22] in 1928 and hot air injection was tried by Hartman[23] in 1942. However, the low heat-carrying capacity of gases renders these techniques of doubtful utility because of the resulting long periods between initiation of a gas-driven thermal wave and the appearance of a temperature rise at a production well.

It is interesting to note that a review of Hartman's test indicates that he may have actually ignited the formation, inadvertently initiating a different type of recovery process — in-situ combustion.

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To be continued

The second part of this article, a discussion of in-situ combustion, will be published next month. ★ ★ ★

THE ATLANTIC LECTURES OF THE UNIVERSITY OF TEXAS

PART 4a

WELL LOGGING: Today and Tomorrow

Present logs help find oil, guide testing, and aid reservoir engineers . . . yet unsolved logging problems remain . . . log combinations, a new porosity tool, and computers promise more, better answers

A. J. Pearson, *Senior Reservoir Engineer, Atlantic Refining Company, Dallas*

WHEN MOST WELLS were drilled with cable tools, there was only one well log — the driller's log. The hole was bailed every few feet to remove cuttings so any change in formation was soon detected. Since the hole was nearly empty, any permeable zone produced fluid into the well bore. The record of this production plus the record of the formations penetrated made up the driller's log.

When fluid filled a cable tool hole, the driller knew he had found a permeable bed. There was not much doubt about the kind of fluid – if a formation contained water, the hole filled with water. If the bit unexpectedly encountered oil or gas, the well probably blew out. Nobody worried much about well logs — many companies didn't even bother to save samples of the cuttings.

But in a relatively few years most of the shallow oil was found and cable tool drilling became too expensive or even impossible. In a rotary-drilled hole, the weight of the mud column kept the fluid in the permeable zones from entering the well bore. Some type of logging was needed to locate potential pay zones. Scientific well logging really began with the end of the cable tool era.

In the past 25 years interest in well logs has pyramided until today almost every major oil company is devoting research effort to well logging. Most companies conduct schools to train their engineers and geologists in the art of interpreting electric logs. Many companies have set up special sections to study and analyze logs. Technical papers on well logs are a large portion of the program at our AIME meetings. Almost every industry magazine contains frequent articles on logging. Why is there so much interest in well logging?

First, through study of electric logs we can find additional oil. Each day it becomes more difficult and more expensive to find oil and gas. As the cost increases, it becomes more and more important not to overlook any potential oil reservoirs — not to plug as dry holes any wells that could have been commercial producers. Today we recognize that through engineering use of well logs we can find oil and gas reservoirs that otherwise might be overlooked.

One of the most quoted examples of a field discovered solely by electric logs is Elk City field in Oklahoma. Then, there are many cases where a so-called dry hole has been drilled — only later to be surrounded by producing wells. The University Block 31 field in Texas is a notable example of this type. Are we missing any comparable fields by improper use of well logs today?

Almost as important is the money that can be saved by scientific use of

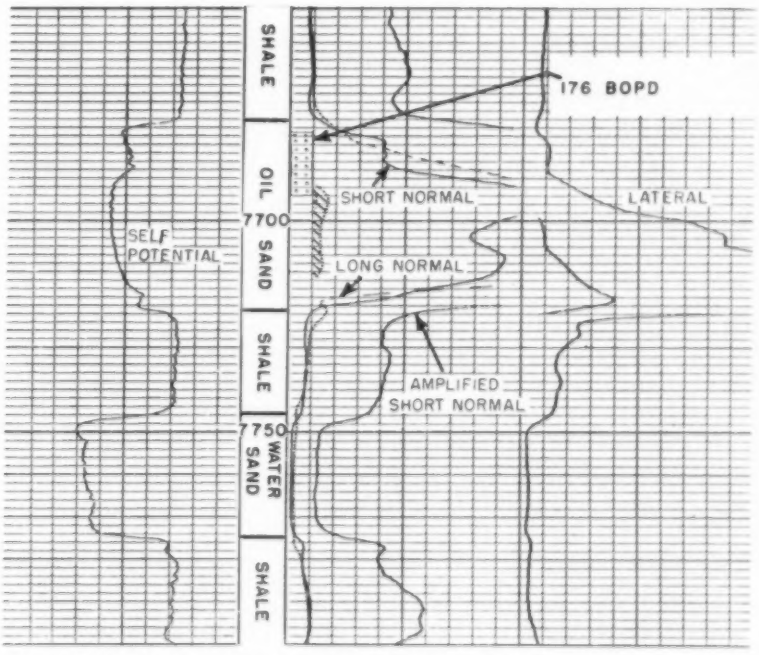

FIG. 1. **Log shows all resistivity curves, Miocene formation, South Louisiana.**

well logs. If we set casing and test every permeable zone, we won't pass up any oil zones. Of course, the cost of doing this is prohibitive — we depend on our well logs to tell us which zones to test and how to test and complete our well.

Well logs are vital to engineering study of a reservoir. Often we know that a formation will produce oil or gas. We still need well logs to tell us the type, structure, net pay, porosity, and lenticularity of the formation. Most of our reservoir engineering studies begin with study of electric and nuclear logs.

The importance of well logging is recognized by the petroleum industry. Perhaps it is just as important to realize that well logging is still a relatively new field. We still can't get the answer we need from logs in many cases. Before discussing some typical cases, it may be well to review the fundamentals of electric log interpretation.

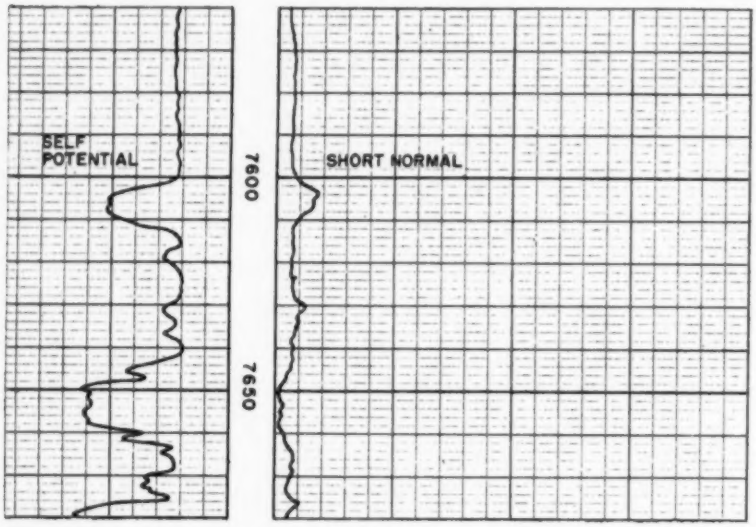

FIG. 2. **SP and short normal** resistivity in Miocene formation, South Louisiana well.

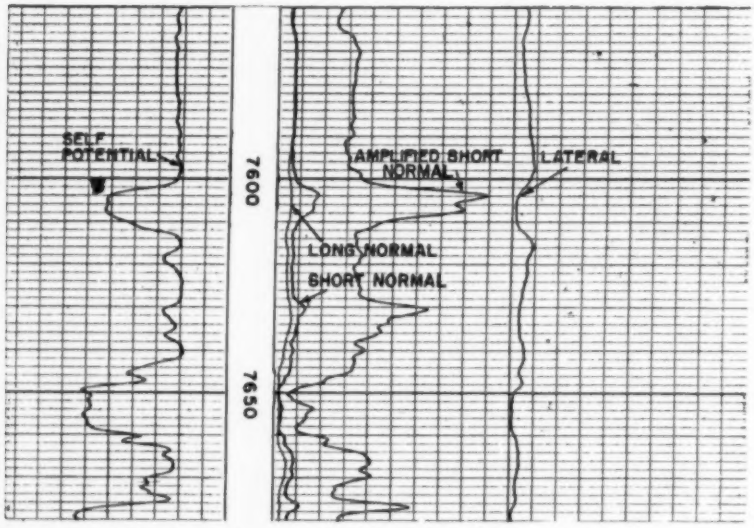

FIG. 3. **Complete electrical survey** of same well shown in Fig. 2.

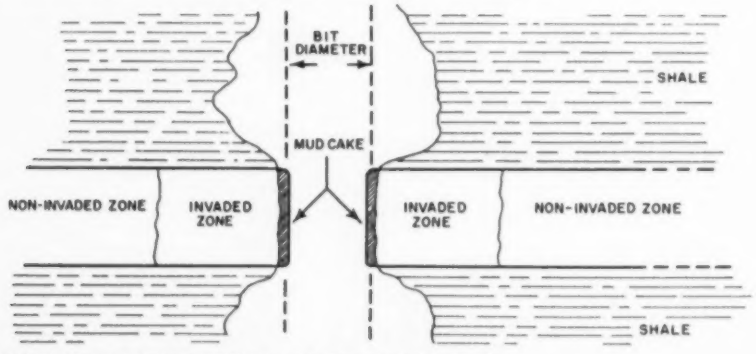

FIG. 4. **Normal hole condition** at the time of electric logging.

Fundamentals of Electric Log Interpretation

The electrical resistivity of a formation depends on the resistivity of the rock network itself and the resistivity of the fluids contained in the pore space. Rock itself has a very high resistivity — sometimes a billion ohm-meters. Both oil and gas have extremely high resistivity. But water has a relatively low resistivity — varying from .02 to 10.0 ohm-meters. All sedimentary rocks contain some void space or porosity, and all of these rocks that are below the water table contain some water. Even a rock that will produce only oil and no water will have irreducible water saturation varying from 5 to 60 percent of the pore space. The overall resistivity of a formation is controlled by the water because water has low resistivity and all other components of the formation have high resistivity.

The Archie Equation

The factors affecting the resistivity of a rock containing some water in its

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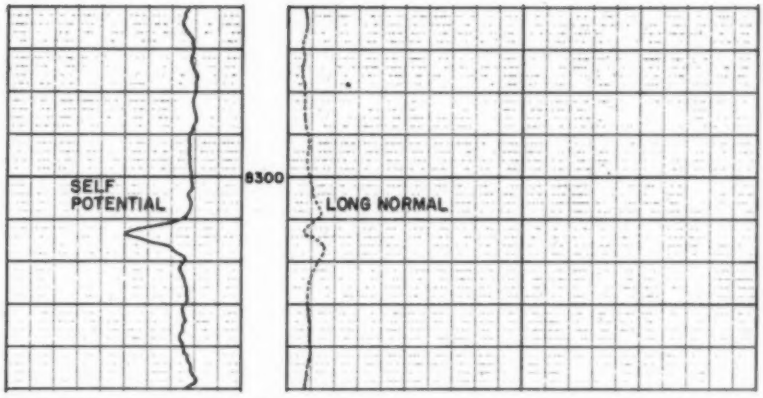

FIG. 5. **Self potential and long normal** resistivity curve for a thin Cockfield sand in South Louisiana.

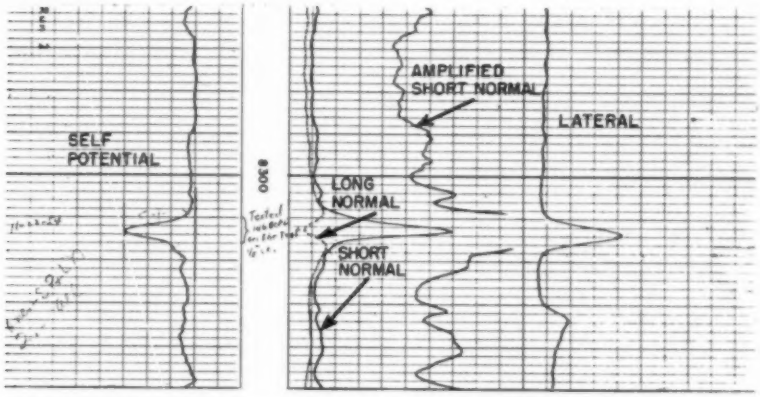

FIG. 6. **Complete resistivity survey** of the same Cockfield sand shown in Fig. 5.

pore space are expressed by an empirical relationship, the Archie equation:

$$S_w = \left(\frac{F R_w}{R_t}\right)^{\frac{1}{n}}$$

where

S_w = water saturation. Oil (or gas) fills the pore space that water does not.

F = formation resistivity factor. The formation factor is a function of porosity. This term really expresses the fact that more water will be contained in a formation of high porosity than one of low porosity. The resistivity of a rock completely saturated with water is equal to the formation factor times the resistivity of the water in the rock.

R_w = water resistivity

n = saturation exponent. (Theoretically this term is related to wettability.) In practice this term is not critical and may be assumed to be 1.8 or 2.0.

R_t = true formation resistivity.

The quantitive interpretation of electric logs is really determining true formation resistivity, porosity (or formation factor), and water resistivity. Once these factors are determined, the Archie equation may be solved to find water and oil saturation.

Determination of Resistivity

One of the factors we must determine to tell whether a formation contains oil or water is true resistivity. Sometimes this is easily done. Fig. 1 shows an electric log illustrating Miocene sands of Southern Louisiana. This particular electric log or conventional electrical survey is composed of the self-potential curve and several resistivity curves (called normals and laterals).

The self-potential curve shows which zones are shale and which are shale-free or sand. From our resistivity curves we can readily tell which sand is high resistivity (or oil) and which is low resistivity (or water). It doesn't require a great deal of skill to interpret a log of this type.

In Fig. 1 all resistivity curves show about the same resistivity. It is not always this simple. Fig. 2 shows only the SP and the short normal resistivity curve for a well in Southern Louisiana, again illustrating Miocene sands. The self-potential shows which intervals are shale and which are shale-free or sand. Comparing the sand at 7605 ft with the sand at 7650 ft, we see a significant difference in resistivity. This leads us to believe that perhaps the sand at 7605 ft contains oil or gas. Fig. 3 shows the complete electrical survey. Unlike the short normal resistivity curve, the long normal and lateral resistivity curves show only a slight difference in the resistivity between the top and lower sands. Actually both sands (at 7605 and 7650 ft) contain salt water.

The difference between the resistivity shown by the short normal and the other curves is caused by the difference in their depth of investigation. The short normal records only the resistivity of the formation near the well bore.

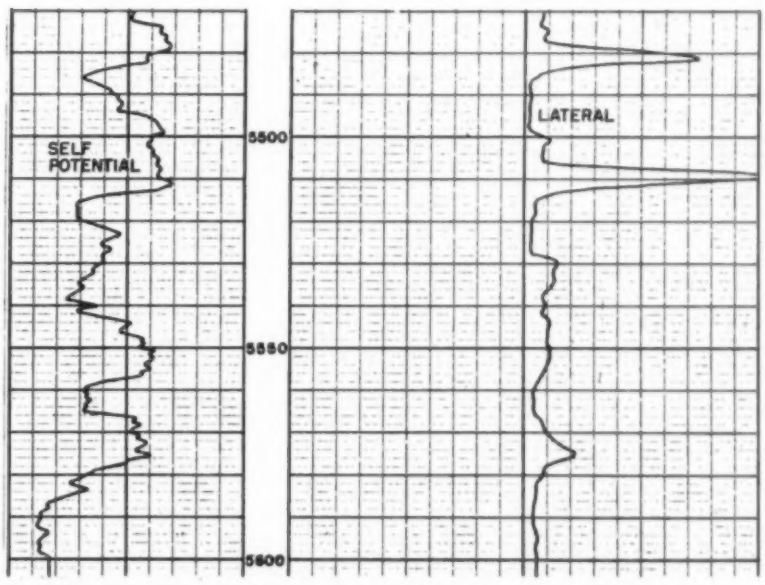

FIG. 7. **Self potential and lateral curve** for the Wilcox formation in a Mississippi well.

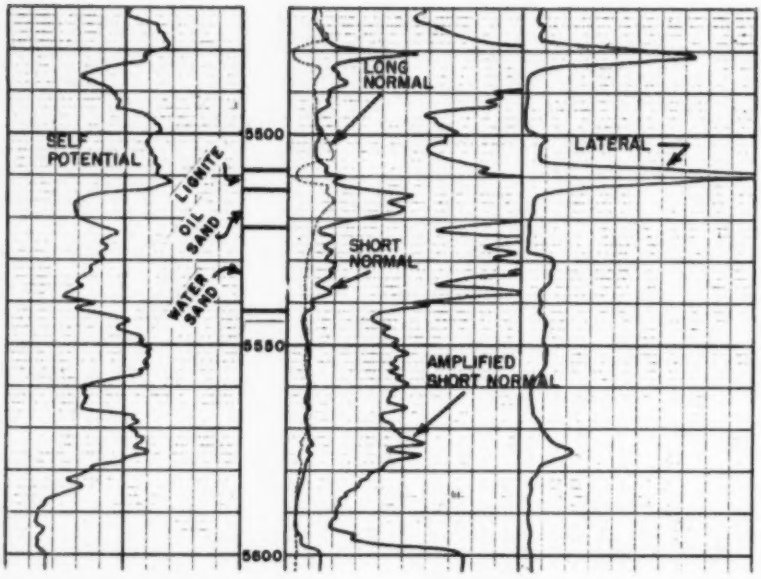

FIG. 8. **Complete electrical survey** of Wilcox zone in Mississippi well shown in Fig. 7.

The pressure of the mud column in a rotary-drilled hole must be greater than formation pressure — otherwise the well would blow out. As a permeable zone is drilled, the water filtrate from the mud invades the formation leaving the solid mud particles plastered on the formation face as mud cake. This is illustrated in Fig. 4. The mud filtrate displaces the fluid in the rock just as efficiently as any water flood. As a result, near the well bore we find an invaded zone containing mud filtrate (and residual oil if oil was present before invasion). For most muds the mud filtrate resistivity has higher resistivity than does formation water.

The short normal resistivity curve has a shallow depth of investigation, therefore it often reads the resistivity of this invaded zone rather than the resistivity of the non-invaded zone. This explains the performance of the short normal in Fig. 3. So we usually can't determine true resistivity from the short normal curve.

The long normal curve has a greater depth of investigation than does the short normal curve, but if invasion is deep, it too may read the invaded zone. In addition the long normal cannot be used for thin zones. Fig. 5 shows the self-potential and long normal resistivity curve for a thin Cockfield sand in Southern Louisiana. The long normal curve shows very low resistivity. In Fig. 6 we see the complete electrical survey — all resistivity curves except the long normal indicate high resistivity. The apparent low resistivity on the long normal curve really means that our sand has high resistivity. This characteristic is known as "reversal" and is typical of the long normal in thin resistive beds. The simple case illustrated is not difficult to interpret but, in a zone containing thin layers of alternate high and low resistivity, it is almost impossible to decipher the long normal curve. This, combined with the effect of invasion on the long normal, seriously limits the use of this curve.

The long lateral curve is less affected by invasion than are the shorter-spaced normal curves. But it, too, has its troubles. Fig. 7 illustrates the self-potential and lateral curve for the Wilcox formation in a Mississippi well. In this figure we see apparent high resistivity at 5510 ft with low resistivity below. The complete electrical survey is shown in Fig. 8. From a study of all curves, we see that we have a high resistive zone (lignite in this case) at 5510 ft. Immediately below we find not a low resistivity zone but one of moderate resistivity from 5513 to 5522 ft. This is an oil sand. The low resistivity on the lateral curve is an anomaly caused by the high resistivity bed above. The lateral curve is greatly affected by the resistivity of nearby beds. Even though we can usually recognize these lateral curve peculiarities, interpretation is very difficult in heterogenous beds using the lateral curve.

Normal and lateral curves have been run as a part of the conventional electrical survey for many years. Usually the trained log analyst can interpret the curves and estimate the true formation resistivity but often without complete confidence in the answer. And as a practical matter, few of our reservoir engineers and geologists can devote enough time to log interpretation to become expert enough to really interpret normal and lateral curves.

Another Curve Needed

Another type of curve is needed. This curve should have a deep depth of investigation — something like the lateral curve. But our ideal curve should not be affected by adjacent beds. It should be able to read resistivity in thin beds and thick beds. Most important, it should be easy to interpret. As yet no curve or log has been developed that will meet these requirements in all cases. But in recent years two types of logs have been introduced that come close to these requirements if run under the proper conditions. These are the guard electrode (or laterolog) and the induction log.

A laterolog is illustrated in Fig. 9. This formation is the Nesson lime in North Dakota. The curves illustrated

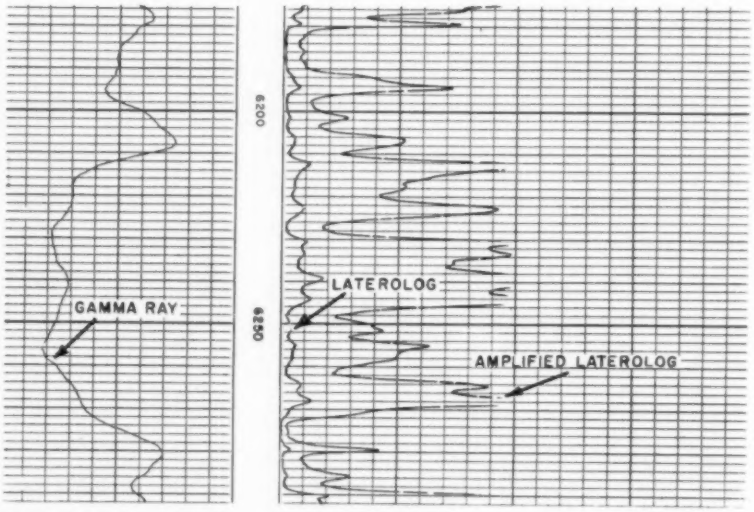

FIG. 9. **Laterolog** of the Nesson lime in North Dakota.

are the gamma ray curve on the left and the laterolog on the right. The pay zone in this well consists of thin, porous (low resistivity) streaks of lime interbedded in a massive lime section. While the resistivity of the higher resistivity zones is important, the higher porosity and, hence, most of the oil is found in the low resistivity zones.

The laterolog clearly shows the resistivity of these porous streaks — the conventional normals and laterals could not. This log has a gamma ray log instead of the self-potential curve we have seen on previous illustrations. The gamma ray curve is used much like the self-potential — to point out the difference between shale and shale-free beds. Like the self-potential it shows shale to the right and sand or lime to the left. A gamma ray log was used instead of the self-potential because this well was drilled with mud of very low resistivity. As will be discussed later, the self-potential shows little detail in this case, so the gamma ray curve is normally used in salt water mud.

In Fig. 10 both the laterolog and the electrical survey are shown for a well producing from the Wolfcamp formation in New Mexico. From the laterolog we can tell that a dense highly resistive zone is present from 7922 to 7927 ft with a porous low resistivity zone from 7927 to 7935 ft. We can read the resistivity of the porous interval directly from the laterolog. From the conventional electrical survey, it is difficult to locate the porous zone and impossible to determine its true resistivity.

We stated previously that the laterolog or guard electrode worked well under certain conditions. The laterolog and guard electrode are so designed that they measure resistivities of the invaded zone and non-invaded zone in series. If the invaded zone resistivity is very low, as is the case when a well is drilled with salt water mud, we can determine the resistivity of the non-invaded zone quite accurately. On the other hand, if the resistivity of the invaded zone is large in respect to the resistivity of the non-invaded zone, it is impossible to determine true resistivity from the laterolog.

The induction log is the other new tool we mentioned, as illustrated in Fig. 11 which shows Miocene sands in Southern Louisiana. Actually, the induction log was developed many years ago, but its popularity is quite recent. Note how clearly the sand at 9850 ft is shown to be resistive; how clearly the sands from 9885 to 9900 ft are shown to be low resistivity. With this log it is easy to tell that the upper sand contains oil and that the lower sands contain water. The induction log is normally presented both in conductivity and resistivity scales. The conductivity scale is the reciprocal of the resistivity and shows great detail in the low resistivity range.

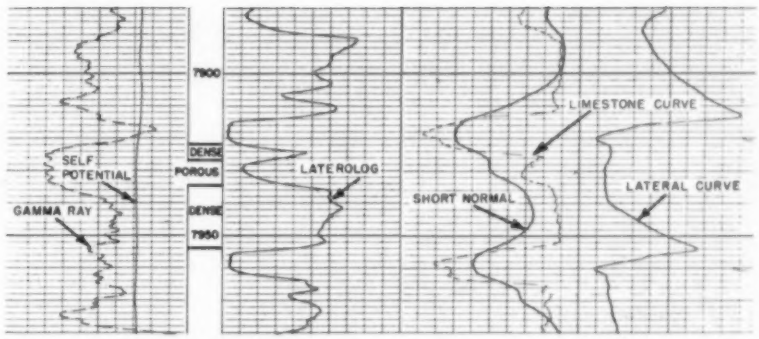

FIG. 10. **Laterolog and electrical survey** of a well producing from the Wolfcamp formation in New Mexico.

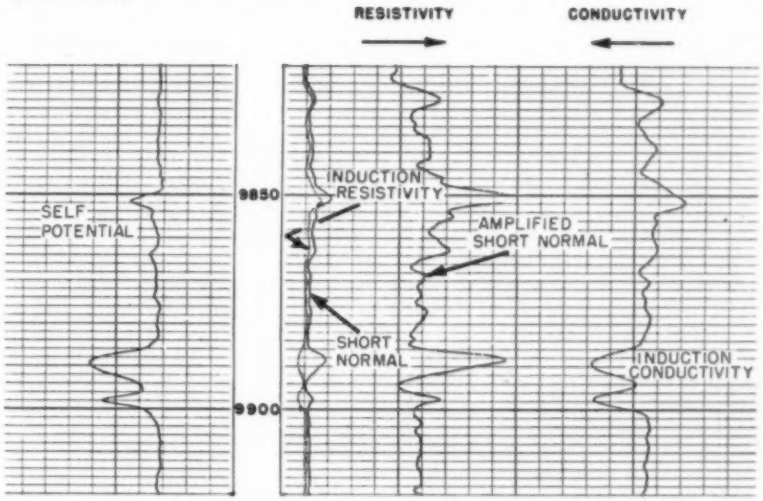

FIG. 11. **Induction log** of well in Miocene sand, South Louisiana.

Fig. 12 shows a comparison of the induction and conventional electrical logs for a Vicksburg sand in Southeast Texas. From the induction log the resistivity contrast between the oil sand at 7594 ft and water sands at 7605 ft is readily apparent. From the conventional electrical survey, it is difficult to see this contrast. The lateral curve is so greatly affected by the adjacent beds that it is not usable. The long normal is also affected by adjacent beds. The short normal curve does show this resistivity contrast but whether because of invasion or presence of oil we cannot tell.

The induction log is so designed that it measures the resistivity of the invaded and non-invaded zones in parallel. If the resistivity of the invaded zone is high in respect to resistivity of the non-invaded zone, we can measure true resistivity quite accurately. But if the resistivity of the invaded zone is low in respect to the resistivity of the non-invaded zone, it is difficult to determine

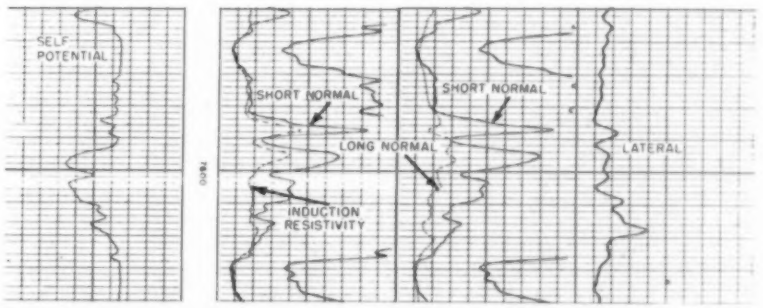

FIG. 12. **Induction log and conventional electric log** compared. Formation shown is the Vicksburg sand, Southeast Texas.

true resistivity from the induction log. The induction log works best where the laterolog fails, and vice versa.

We stated earlier that we needed a resistivity curve with deep penetration that could read true resistivity in thin beds or thick beds, and that was not affected by adjacent beds. We don't have one log that will do this but we do have a choice of two logs — the laterolog (or guard electrode) and the induction log. Usually one will work but not the other. In many wells we need both logs.

Determination of Porosity

But resistivity is only one unknown in the Archie equation. Fig. 13 shows a log from Southwest Texas illustrating the Wilcox section. Again, the self-potential curve readily distinguishes sand and shale. If we look at only the first two sands, we have a situation which is quite similar to Fig. 1. The sand from 7208 to 7248 ft which produces gas has very high resistivity. The sand from 7270 to 7296 ft which contains water has a low resistivity. But, in this same well several hundred feet lower, at 7840 ft, we have another zone. This is obviously a thin water zone since it has similar resistivity to the known water sands above. But this obvious water zone produces oil. The difference between the sands at 7280 and 7840 ft is the porosity. The upper sand has a "normal" porosity for the Wilcox in this field of 18 to 20 percent. But the lower sand has a porosity of 30 percent. Even when we know true resistivity, we cannot depend on visual analysis for electric log interpretation. A change in resistivity between two sands may be due to a change in porosity and formation resistivity factor rather than to a change in water saturation.

Fig. 13 shows that we must know formation resistivity factor (and porosity) to determine whether a zone will produce oil or water. (Since formation factor is a function of porosity, we can determine either one if we know the other.) There are many ways to determine porosity and formation resistivity factor. Of course, the most obvious way is to core the well and analyze the core. But frequently we must make our decision before the core is analyzed. Then, too, every zone in a well cannot be cored because of the prohibitive cost. In an exploratory well it is impossible to core only the "interesting" zones. If the rock is not too hard, it can be side-wall cored. But often potential pay zones are missed even when side-wall cores are cut. We need to determine porosity and formation factor from a log rather than depend entirely on core analysis. In the last 10 years a number of logs have been developed to give us porosity.

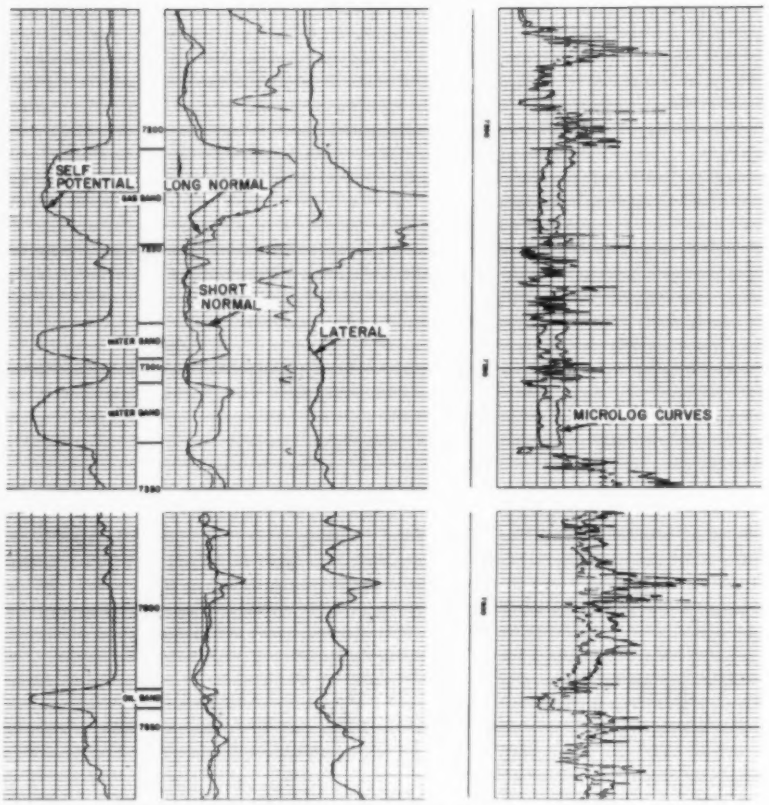

FIG. 13. **Log of the Wilcox** section of a Southwest Texas well illustrates the need for knowledge of the formation resistivity factor to determine whether a zone will produce oil or water.

In Fig. 4 we saw that mud filtrate invades the formation. This has a harmful effect on most resistivity curves but has been turned to advantage in two tools for measuring porosity — the microlog and the microlaterolog. Since the formation factor is defined as:

$$F = \frac{\text{Resistivity of a zone Saturated with water}}{\text{Resistivity of the water}}$$

we can determine formation factor by measuring the resistivity of the invaded zone and the resistivity of the mud filtrate. The microlog (also known as contact log, micro-survey, and minilog) and microlaterolog (also known as FoRxo log) measure only the resistivity of the invaded formation very near the well bore.

A microlog is illustrated in Fig. 14.

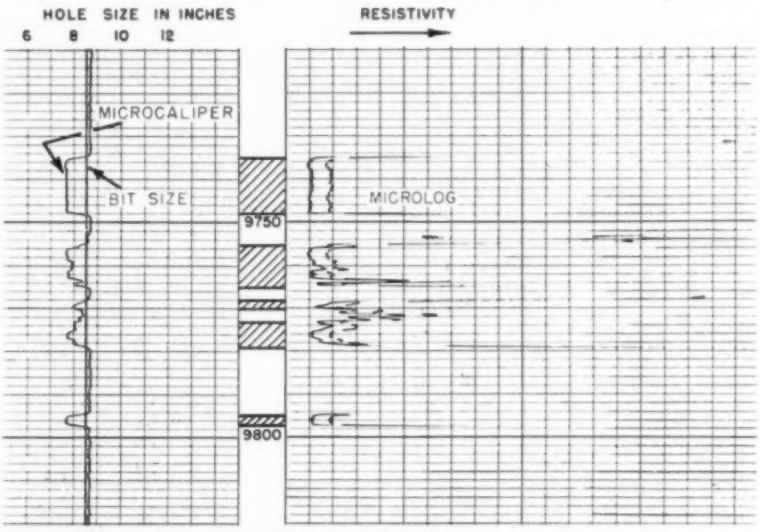

FIG. 14. **Microlog** of the Beaverhill Lake formation in Canada.

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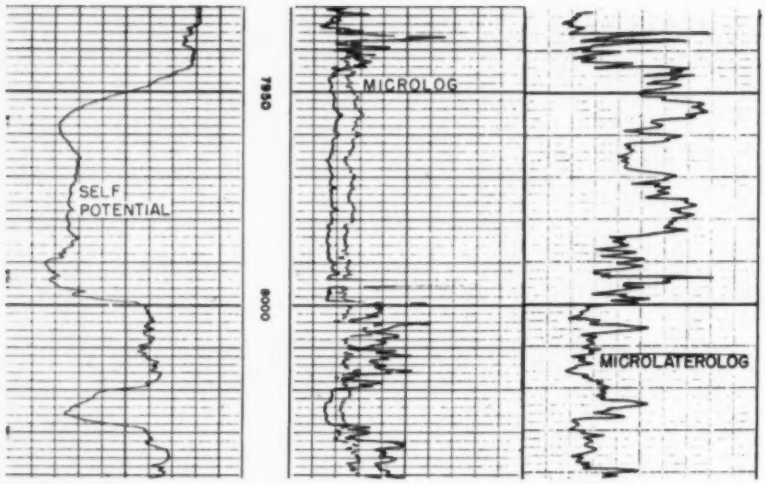

FIG. 15. **Microlaterolog** and microlog are compared. Wilcox sand, Southwest Texas.

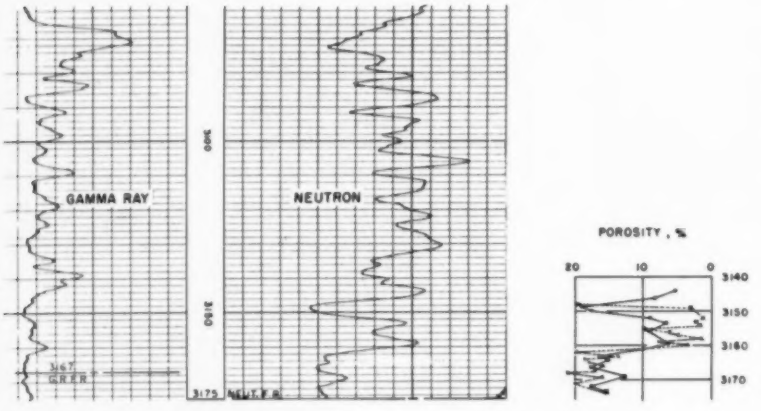

FIG. 16. **Neutron log** of a section of Grayburg formation, West Texas.

This is a well from Canada showing the Beaverhill Lake formation. This is a reef formation with porous intervals in a massive lime section. The curves illustrated in Fig. 14 are the microcaliper on the left and the two curves of the microlog on the right. When compared with bit size the microcaliper shows the amount of mud cake. The separation on the microlog indicates a permeable zone. It is easy to interpret this log — to pick out the permeable zones which are cross-hatched on the figure. Perhaps the nicest feature of the microlog is this qualitative use. Unfortunately, it is not too good a quantitative tool although porosity can be calculated using the resistivity readings in the permeable zones. The porosity calculated from the log is usually fairly good if porosity is 20 percent or greater — if porosity is less than 20 percent, the calculated porosities may be very misleading.

The microlaterolog. Because the microlog did not give good quantitative results, the microlaterolog was developed. A microlaterolog is compared with a microlog in Fig. 15. The microlaterolog shows much greater detail than does the microlog. In addition, calculation of porosity from the microlaterolog is superior to that from the microlog, especially if true porosity is less than 20 percent.

The neutron log. For many years the neutron log, a nuclear log, was used as a quantitative indicator of porosity. This log works on the theory that neutron travel is less through porous rocks than in non-porous rocks. In recent years through careful calibration the neutron has been made quantitative. An example of the neutron log is shown in Fig. 16. The porosity calculated from the neutron log is compared with porosity from core analysis. The neutron does not always work this well — particularly if the formation is somewhat shaley.

Velocity log. Recently, the acoustic velocity log has been introduced as a porosity tool. This log has been used for some time by the seismologist but only in the past year has it been used extensively as a porosity tool. The velocity log works on the principle that sound waves travel slower in a porous rock than in a non-porous rock of the same type.

A velocity log is shown in Fig. 17 for the Pettit formation in Northeast Texas. Porosity calculated from this log is shown compared with microlog and core analysis porosity. The porosity calculated from the velocity log almost duplicates core porosity — the microlog shows porosity much too high. This figure also illustrates the qualitative use of the microlog — it is much easier

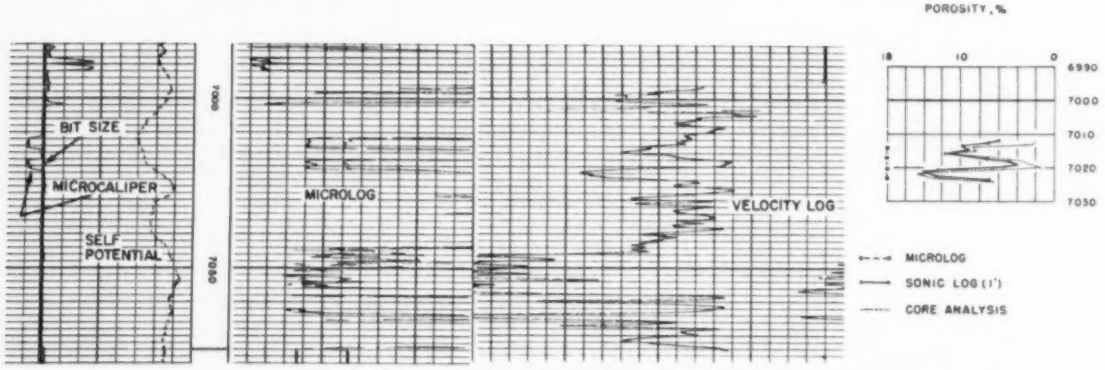

FIG. 17. **Velocity log** for Pettit formation, Northeast Texas.

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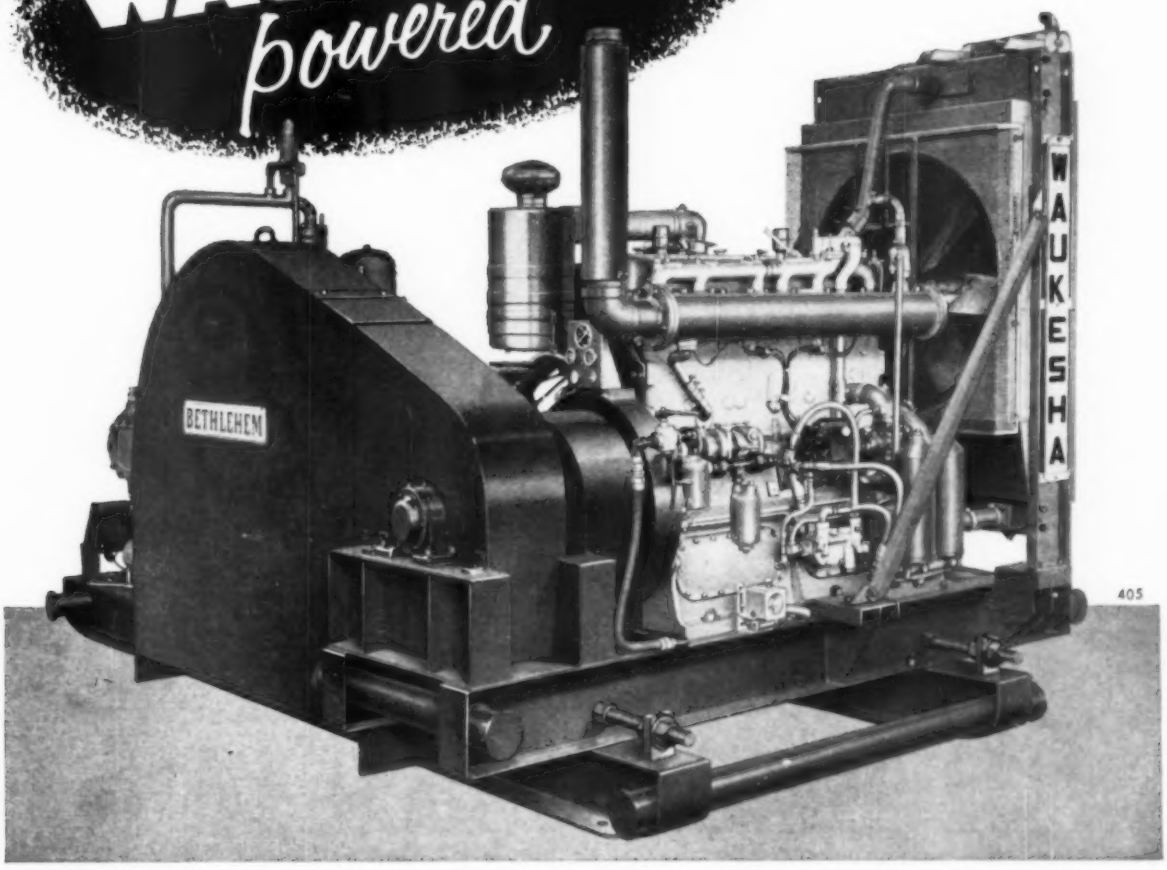

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to find the permeable zones on the microlog than on the velocity log.

Determination of Water Resistivity

We have discussed two of the unknowns in the Archie equation: Resistivity and formation factor. The third unknown is water resistivity. Fig. 18 shows three sands — a fresh water sand, an oil sand, and a salt water sand. The contrast in resistivities illustrates the importance of water resistivity. The key to water resistivity is the SP curve.

The self-potential curve is one of the most useful of all electric log curves. Primarily it distinguishes between permeable or shale-free formations and impermeable or shale zones. The amount of deflection observed between a shale-free sand and a shale is a function of the ratio of mud filtrate resistivity to formation water resistivity. In ideal cases we can determine water resistivity from the SP but the problem is complicated by the fact that few sands and limes are "shale-free."

In most areas water resistivity doesn't vary much in a formation from one field to the next and we can often use our file of water analyses to determine water resistivity.

Use of Electric Logs

We have discussed use of electric and nuclear logs to determine individually the three factors in the Archie equation. A few typical examples of log use may be of interest.

Kansas discovery. Fig. 19 shows the discovery well for a Kansas field. The producing zone is the Cherokee sand at 4220 ft. This field was discovered entirely by log analysis. Most of the Cherokee interval was tested but one short interval that contains the producing sand was not. Since there was no show in the cuttings, the well would have been plugged but for a careful inspection of the electric log. The logs illustrated here are the gamma ray (which shows a shale-free formation at 4220 ft), the laterolog (which shows a resistive formation), the microcaliper (which shows a permeable zone), and the microlaterolog (which shows good porosity). This information, together with water resistivity data from the area, showed that this formation should produce oil. The well produced at the rate of 400 bbl of oil per day.

Now this is no major field since it contains only five producing oil wells and will produce only about 600,000 bbl. But certainly this 600,000 bbl will pay for a lot of electric log study.

An Oklahoma log. Another interesting log — because it too resulted in a discovery — is Fig. 20, a log from Southern Oklahoma. The formation shown is the Wapanucka lime. This

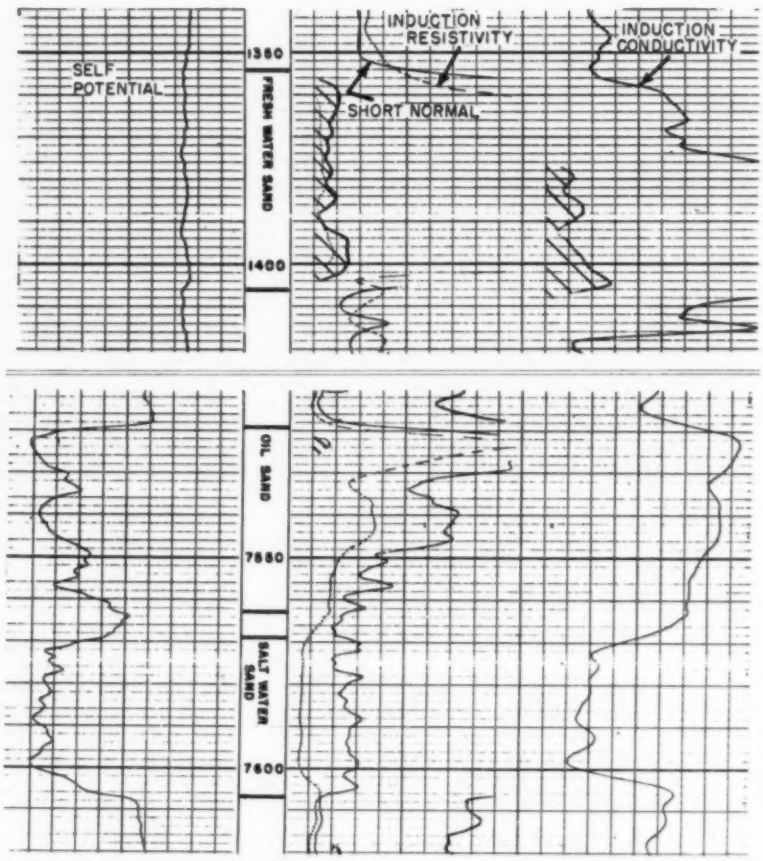

FIG. 18. **Log of a Texas Gulf Coast well,** showing fresh water sand, oil sand, salt water sand.

formation had not been found productive in the area and no stain was observed in the samples. Only one piece of evidence pointed toward the presence of gas or oil — the electric log. The logs illustrated show high resistivity, and a permeable, porous zone. Since in this area all formations contain very low resistivity water, the solution of the Archie equation indicated that this zone contained hydrocarbons. This well produced at the rate of 25,000,000 cu ft of gas per day. The field has not been defined but proved gas reserves are believed to be in the order of 40 billion cu ft of gas.

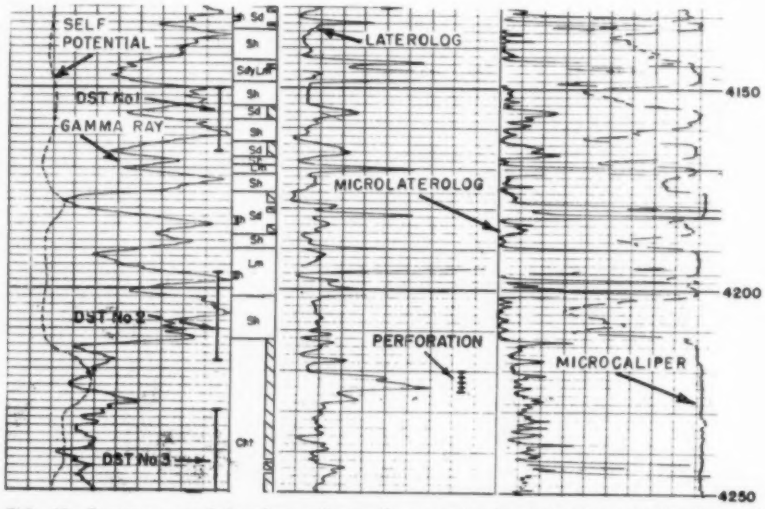

FIG. 19. **Gamma ray, laterolog, microcaliper, and microlaterolog** of Cherokee and Mississippian formations, Kansas.

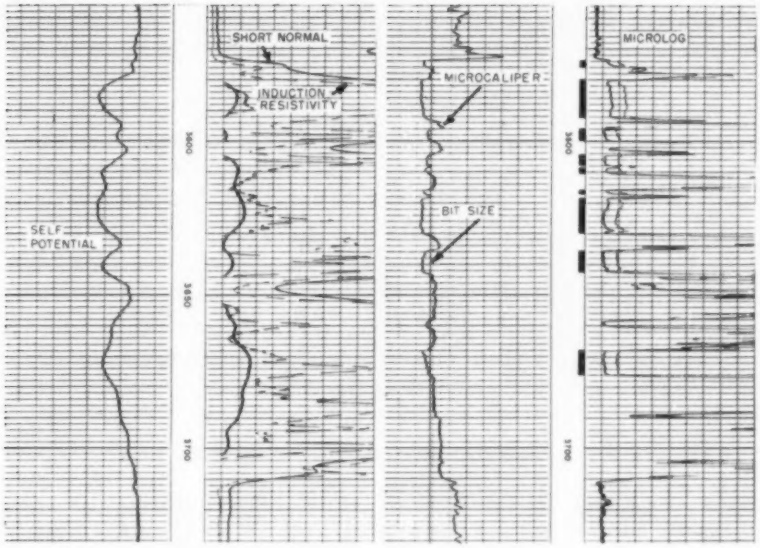

FIG. 20. **Logs of Wapanucka Lime** section in Southern Oklahoma.

Again, this is no major field — but certainly worth developing.

Southern Louisiana. Now finding oil or gas with electric logs is the glamorous side of log interpretation. But there is another important aspect. Fig. 21 shows a Miocene sand in Southern Louisiana. This zone was side wall cored and, from both inspection and analysis of the cores, looked as good as any oil zone in the field. But the electric log tells a different story. The porosity was known from side wall cores and checked with the microlog. The water resistivity was known for the field and checked with the self-potential. The resistivity of the formation was clearly defined by the induction log which shows a very slight increase in resistivity in the zone where oil shows were found. Putting these factors together, oil saturation was estimated to be 10 to 20 percent — or residual oil. Log analysis tells the story. Nevertheless, the zone was tested at a cost of $10,000 and, as the log analyst expected, produced water with no show of oil. That $10,000 could have been saved.

In many cases, we know from other data whether or not a formation will produce oil or gas. The reservoir engineer still needs the electric logs for correlation, to determine net pay, and to determine the average porosity of that net pay. These data are essential to reservoir engineering studies.

Unsolved Logging Problems

Perhaps the most difficult problem in electric log anlysis is to know how much confidence to put in the calculated results. It is not enough to automatically solve our simple equations. Electric log interpretation is not a precise science but, rather, an art. Let us look at a few of our unsolved logging problems.

Southeast Texas. Fig. 22 illustrates Cockfield sands in Southeast Texas. The lower sand at 6400 ft is a water sand with a resistivity of 0.3 to 0.6 ohm-meters. The upper sand at 5990 ft also appears to be a water sand since it has a resistivity of only 0.6 ohm-meters. But it produced 200 bbl of oil per day with only 5 percent water. Using the Archie equation, we would predict that this sand would produce salt water. But this is a shaley sand and we have found that in shaley sands any slight indication of resistivity must be tested. We cannot predict from electric logs which are oil and which are water sands. Though much work has been done in the past few years, we still don't have the answer. The challenge for developing a better logging device can best be expressed by this: It is a rare electric log from the Gulf Coast that doesn't show at least one uncored and untested sand that looks as good on the electric log as the producing sand in Fig. 22. Some percentage of those sands can produce commercial oil but the electric log that can locate them has not yet been developed.

Montana well. Fig. 22 illustrated a sand with low resistivity. Consider now a problem of the opposite type. Fig. 23 illustrates a Montana well producing from the Amsden lime. Our logs in this well show no clue as to location of the pay zone. Even knowing it is within a 50-ft interval, you can't locate the pay zone — much less could you find it in an 8000-ft well. Now this is a fractured reservoir of about 3 percent porosity and admittedly is a difficult problem. But it is not uncommon — many reservoirs from West Texas to Canada have similar characteristics. If the geologist on this well had been less diligent and less competent, this 4,000,000 bbl of oil would not have been discovered. How many similar reservoirs have been overlooked? I don't think we can tell from the electric logs we have today. We need a new type of log to detect this type of reservoir.

Fig. 22 and Fig. 23 illustrate two of the most difficult problems in well logging. There are many others. Invasion greatly affects the accuracy of our resistivity curves. But we have no accurate method of determining invasion

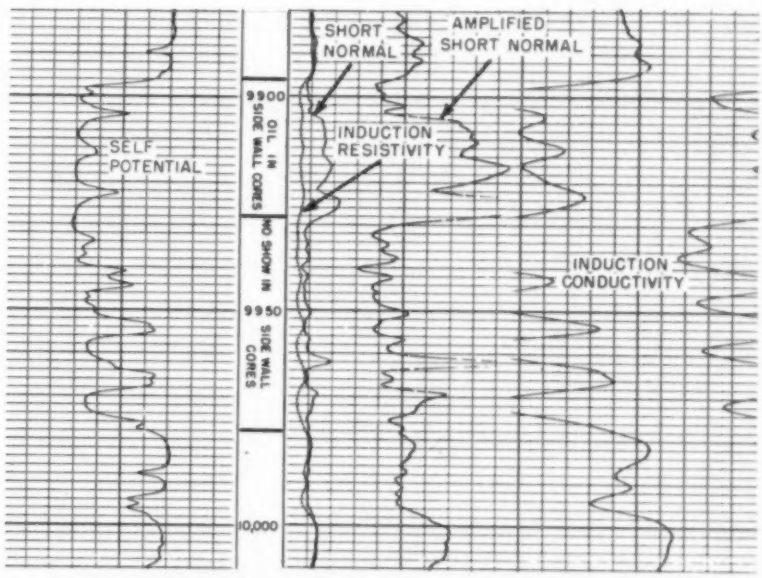

FIG. 21. **Log of non-productive section** of Miocene sand, South Louisiana.

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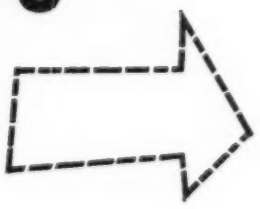

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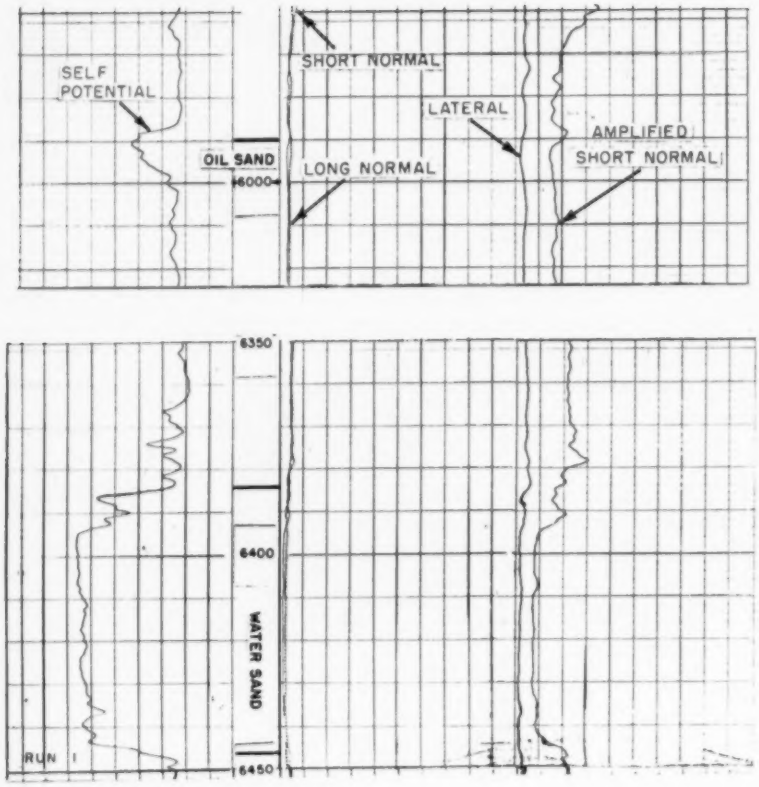


FIG. 22. **Log of Cockfield sands,** Southeast Texas.

either from electric logs or independently. Until we are able to accurately determine the extent of invasion we will not be able to completely solve many of our electric logs.

In the Rocky Mountains many of the reservoirs contain fresh water. Because of the high resistivity shown by fresh water sands, it is virtually impossible to determine whether a sand contains fresh water or perhaps oil and 20 percent salt water. This problem is not limited to the Rocky Mountains — most areas have the same problem though to a lesser extent.

The laterolog and induction log have solved to some extent the problem of thin formations. But some of the zones where we find oil and gas are too thin even for the laterolog and induction log. If enough of these thin zones are present, the formation may well be commercial.

Even though we have a number of different porosity logs, none is satisfactory for the low porosity ranges. Many producing formations have porosities less than 10 percent and even 5 percent. In this low porosity range it is impossible to accurately determine porosity with any of our present logs.

Future of Well Logging

We have shown examples of how the industry can use well logs to find oil and typical cases where log analysis cannot be accomplished with our present logs. What will be developed in the future? Perhaps first we will see improvements in our present logs. We need to determine true resistivity, porosity, and water resistivity to tell whether a zone will produce oil or water. Today, we have logs that we can use to determine true resistivity in ideal conditions. We need a better log, one that will be more general in use — one that we can run and not wish we had run something else in addition. Our ideal resistivity log must be easy to calculate. It must be easily correlated not only with similar logs but with the electrical logs recorded in the past 25 years. Perhaps the first step will be to combine some of the present resistivity measuring devices such as the laterolog and induction log.

Ideal log. Although we have a number of porosity logs—microlog, microlaterolog, limestone curve, neutron, density log, and now the velocity log — none is entirely satisfactory. We need a log that combines the qualitative aspects of the microlog with the quantitative aspects of the microlaterolog or the velocity log. None of our logs is satisfactory for the low porosities. Probably the nuclear logs have greater potential for that range than any other log. An API committee is now working toward a standard unit for the neutron and gamma ray logs. This should be a big aid to quantitative interpretation of those logs.

We need a better method of obtaining water resistivity than the self-potential now provides. What it may be I do not know, but the present method and present logs are inadequate.

One of the factors we would like to determine from logs is permeability. This is a vital problem — one that we should be able to solve with logs — but we cannot.

Digital computers have come into widespread use in the oil industry in the past few years. As yet, they have not been used widely to solve electric logs. Why can't we add the computer to the logging truck and calculate porosity from the microlog and microlaterolog — plotting the results as a porosity curve on the finished log? The same thing could be done with other porosity tools. Since, at the present stage, our interpretation is an art rely-

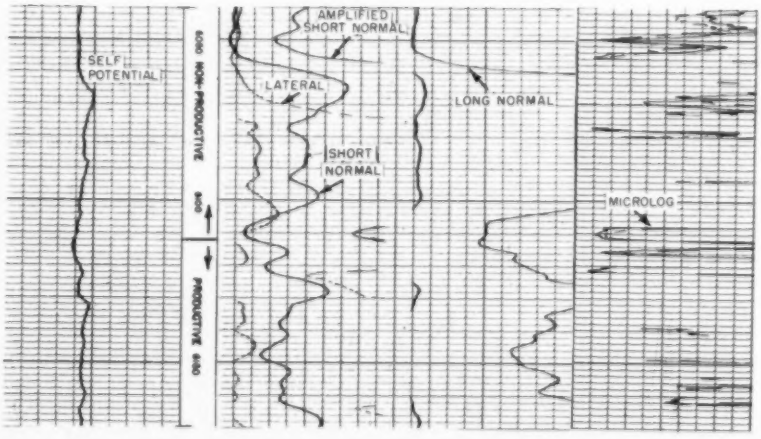
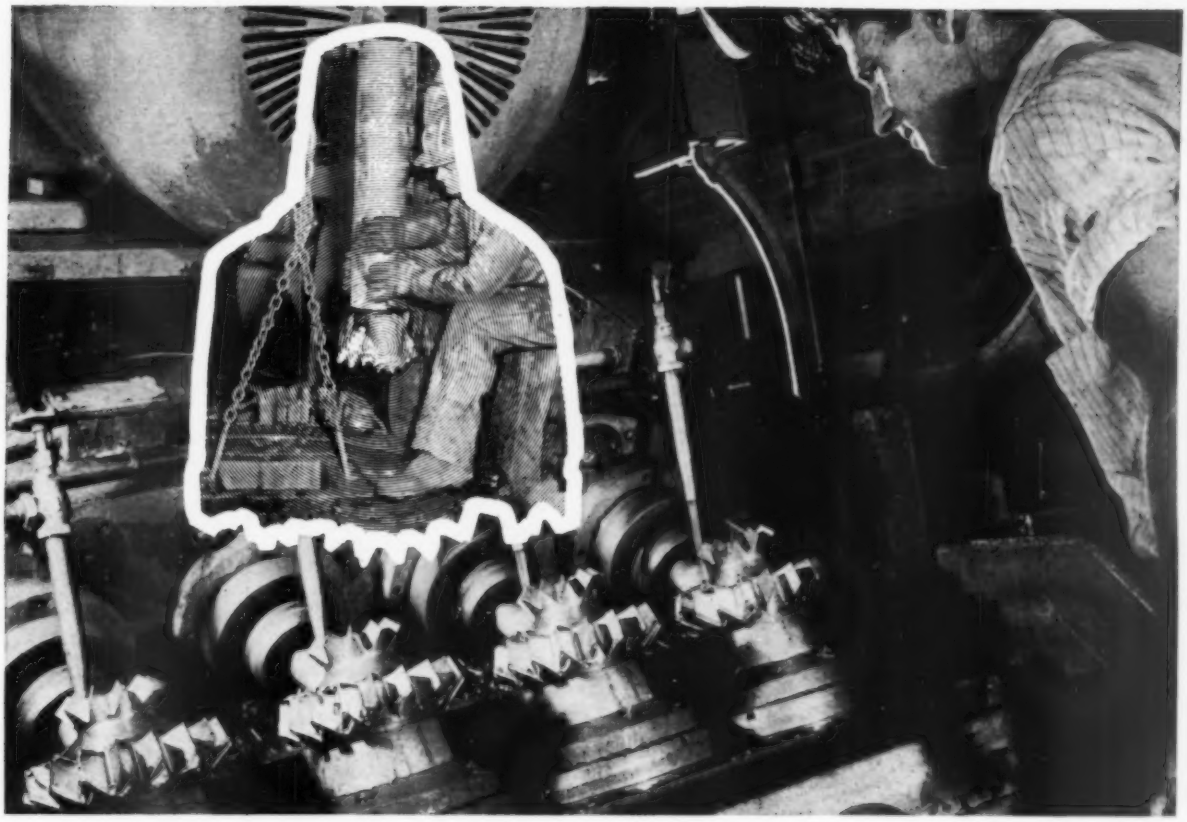


FIG. 23. **Non-revealing log** of productive Amsden lime, Montana.



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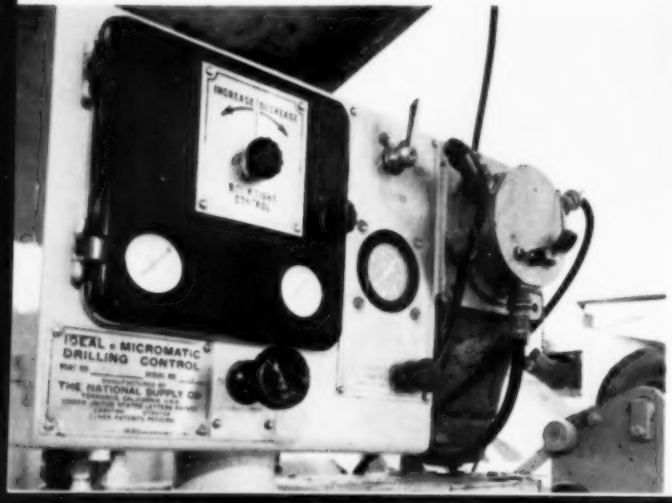

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As you can see, there are many benefits to this system. No single engine is lightly loaded or severely overloaded—a condition which frequently occurs without this drive. A number of rotary speeds can be selected accurately and quickly for various drilling conditions. And, this "cushion" drive for the drawworks and rotary permits fine control on delicate fishing jobs, core reel operations, tonging, wire line moving or renewal.

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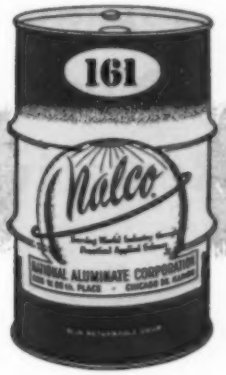

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ing heavily on judgment, computers will not solve all our problems. But perhaps they will help us solve more problems than we are now doing, or at least point out which formations need detailed study.

Direct oil finder. Of course, our hope is that a direct oil-finding tool will be found. One log which offers possibilities in this respect is the displacement log; a new log (being developed by The Atlantic Refining Company) which directly indicates the presence of oil. Many possibilities exist in the field of nuclear logs. Different elements can be identified in the laboratory when bombarded by neutrons — why not in the field?

Conclusion

In conclusion, we use present well logs to find oil or gas — some of the oil or gas. We use well logs to guide us in well completion and to save testing costs. The study of well logs is the first step in our reservoir engineering studies.

But we cannot find all the oil or tell in every case what a well will produce. Until we can, we must keep improving our interpretation techniques, hoping that the continued research by both service and oil companies will eventually enable us to solve the problem logs of today.

At present, we can state from our log interpretation:

1. which zones will certainly produce water,
2. which zones will certainly produce oil,
3. which zones may produce either water or oil.

Too many of the zones we find now fall in the third category. We won't be satisfied with our well logs and our interpretation until we remove that third class and can say in every case with certainty: This zone will produce water and that zone will produce oil.

★ ★ ★

THE ATLANTIC LECTURES OF THE UNIVERSITY OF TEXAS

P 420.112

PART 4b

Displacement Logging: A New Concept in Resistivity Logging

New instrument under laboratory development responds directly to presence of producible oil but does not to presence of residual oil; experimental tests verified, work continues toward acceptable field tool

W. C. Pritchett, *Research Physicist, Atlantic Refining Company, Dallas, Texas*

DESPITE the progress made in recent years, we believe that many holes which penetrated good reservoirs have been plugged and abandoned because of failure to detect the presence of producible oil. The failure to detect producible oil in zones penetrated by the bit is primarily a failure of the logging program. It may be that the logs taken are not capable of showing the presence of producible oil. Or again, it may be that a careful study of all the data would indicate the presence of producible oil. But it is not practical to make a careful analysis of every porous zone which is drilled, and as a result many reservoirs have been missed.

What is needed in the field of logging is a tool which will give a direct indication of the presence of producible oil. The tool should not respond to the presence of residual oil. A tool called the "displacement logger" is now being developed to make this distinction.

THEORY

To understand the theory of the displacement log one must know something of the history of typical reservoirs. At the time of burial the pores of the rock or sand usually contain salt water. Later, oil may migrate through the permeable layers and collect in various types of traps. At any given point in a rock the percentage of oil in the pore space may vary from zero to a high percentage. A small percentage of salt water called "connate water" will remain no matter how much oil flows through the rock. In places where the oil saturation is the "residual oil" value, the oil is immobile. This means that none of this oil will

move or flow if water were flowed through the rock. Such a rock would contain no "producible oil." The oil present in excess of the residual oil is the producible oil.

Connate Water Bank

Now suppose we were to simulate a reservoir by a core containing only oil and irreducible salt water. Suppose further that we force fresh water into one end of the core. The incoming fresh water will push the oil away from the inlet as it does in a waterflood operation. The residual oil would, of course, be left behind the front. The "connate water" originally present in the core is pushed along rather efficiently by the incoming water since it is miscible with that water. The salt water originally present then tends to build up in a bank between the incoming fresh water and the virgin formation containing oil and salty connate water.

The displacement log would not work if a bank of salty "connate water" were not formed between the incoming water and the oil. The validity of this key point was investigated in the laboratory by many experiments with reservoir rock.

Demonstration

A graphic demonstration of the effect was obtained by the use of a glass bead model using two miscible fluids which were colored blue and white respectively, and an immiscible fluid which was colored red. The core was saturated with blue fluid which represented salt water. The core was then flushed with the red fluid representing oil. The color of the entire core then appeared red with only a hint of blue or purple color. The white fluid representing fresh invasion water was then injected in one end. A narrow blue band then formed between the almost white zone and the virgin red zone. As more white fluid was injected, the white zone increased in length, the blue band moved forward and increased in width and the red zone retreated. We believe that this is a striking demonstration of similar effects which occur when zones containing producible oil are invaded by mud filtrate.

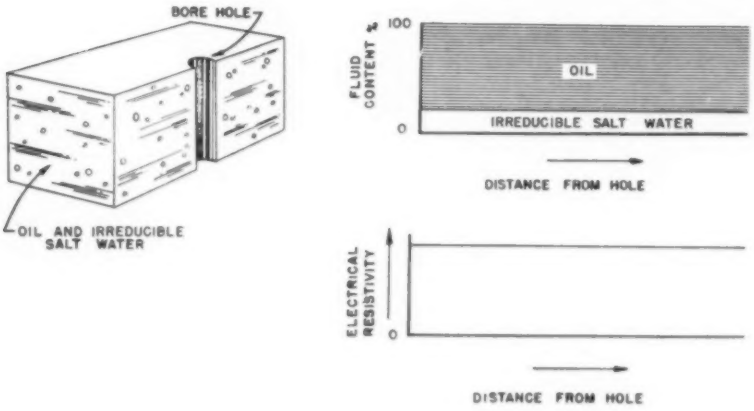

FIG. 1. **Oil zone before invasion** by mud filtrate. Electrical survey, at right, is same near the borehole as it is farther out into the formation.

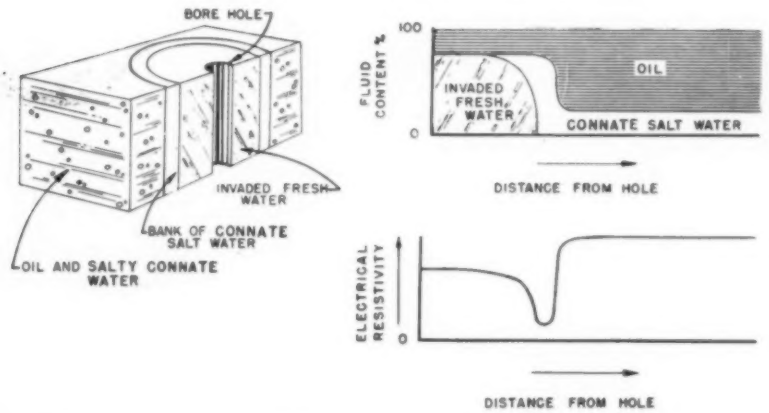

FIG. 2. **After invasion,** the oil zone looks like this. Residual oil remains in the invaded zone, connate salty water is in band ahead of fresh mud filtrate.

Mud Infiltration

Let us now consider what happens to the fluids in a porous rock which is penetrated by a drill. Fig. 1 depicts an oil zone prior to invasion by the mud filtrate. The electrical resistivity of the formation is the same near the borehole as it is farther out in the formation.

Fig. 2 shows this same oil zone after the mud filtrate has invaded some distance into the formation. The residual oil remains in the invaded zone. The connate salty water is in a band ahead of relatively fresh mud filtrate. The fluid boundaries would be irregular but are shown as being sharp in these illustrations. The resistivity of the formation is relatively high near the borehole because the mud filtrate is normally relatively fresh. The resistivity in the virgin formation is relatively high as a result of the high percentage of oil in the pores. But in the band occupied by the connate water, the resistivity is relatively low.

This low resistivity zone between two higher resistivity zones cannot occur in a water zone, however, or in a zone containing only residual oil. The presence of such a low resistivity zone is direct evidence of the presence of movable hydrocarbons, either oil or gas.

Fig. 3 shows a water zone prior to invasion. The resistivity does not vary with distance from the borehole. If the porosity is low, the resistivity might be rather high despite the fact that the connate water is salty. A low percentage of oil (residual oil) may be present in a "water zone."

Fig. 4 shows this same zone after invasion. The residual oil remains in place but the connate water is pushed back by the mud filtrate. Again the actual fluid boundaries would not be sharp. The resistivity is relatively high in the invaded zone due to the relative freshness of the mud filtrate. There is no low zone sandwiched between higher resistivity zones. The low resistivity zone can only be formed if movable hydrocarbons are present.

Measurement — How Deep?

In order to detect directly the presence of producible oil, a measurement

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Question: How much oil and gas in the reservoir?

Question: Is "displaced" oil present under the lease?

Answering the above questions will require a great deal of information—with formation pressures playing the all-important part. Obviously, *accurate* formation pressures must be obtained if either answer is to be anything more than a guess.

Additional drilling or a costly well completion could supply the answer, *BUT* the economical way is a Johnston Drill Stem Test.

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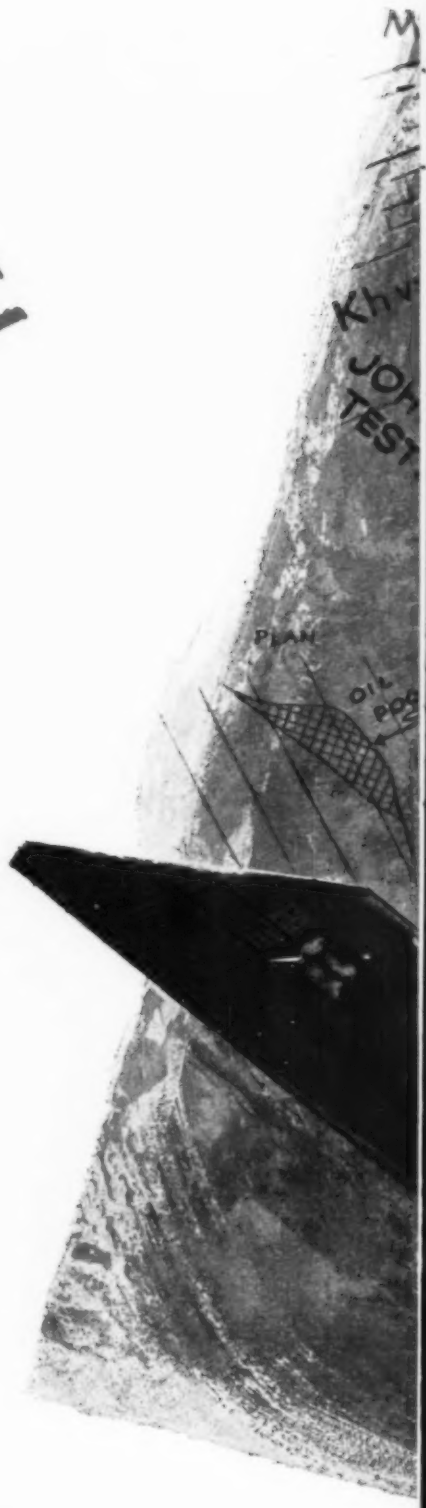
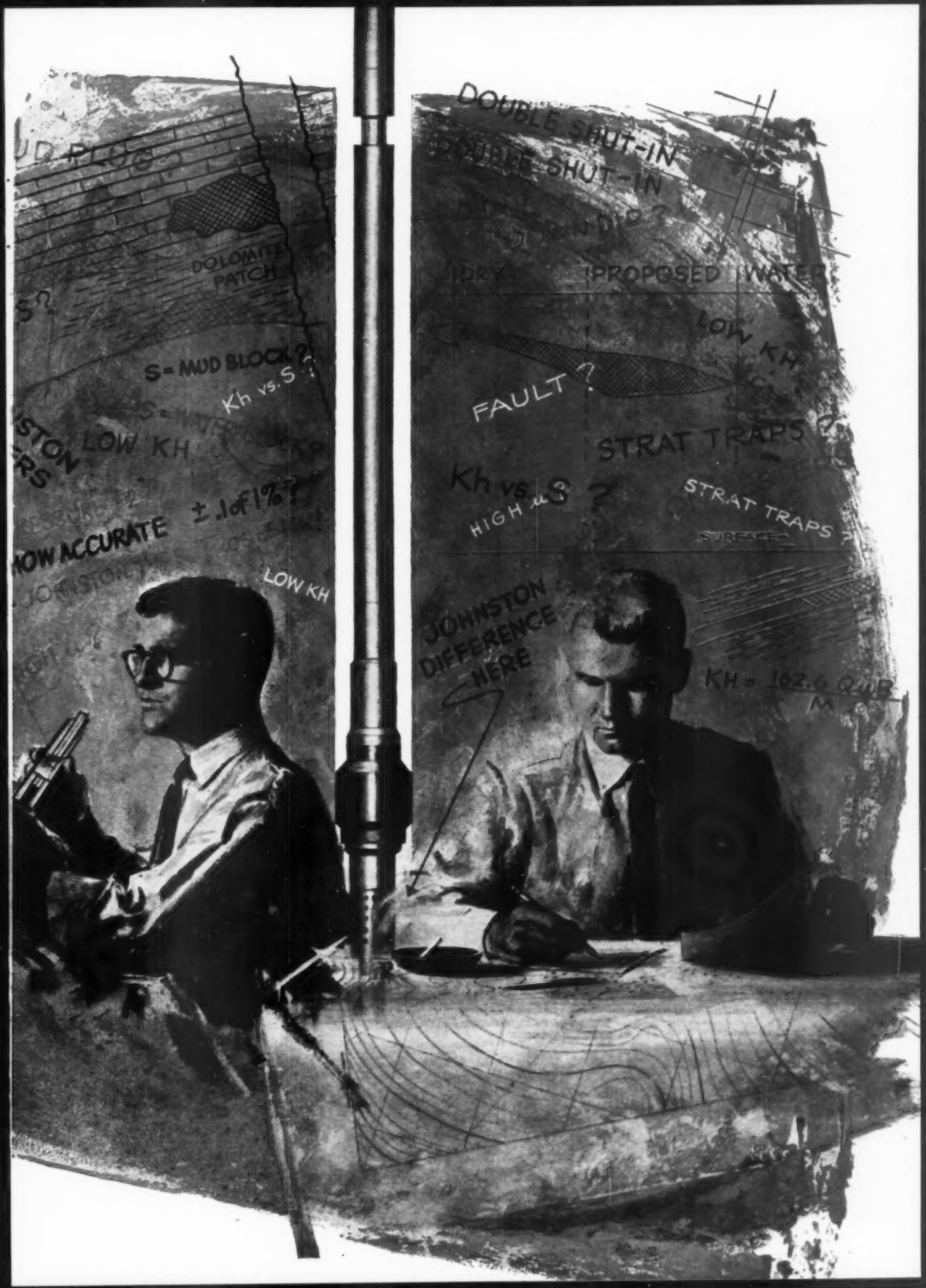



DOUBLE SHUT-IN
DOUBLE SHUT-IN
DRY
PROPOSED
LOW KH
FAULT ?
STRAT TRAPS ?
Kh vs. μS ?
HIGH μS
STRAT TRAPS ?
SURFACE
JOHNSTON DIFFERENCE HERE
KH = 162.6 Q μ B
M
DOLOMITE PATCH
S = MUD BLOCK ?
Kh vs. S ?
LOW KH
HOW ACCURATE ± .1 of 1% ?
LOW KH

system is required which can detect changes in the resistivity as a function of distance from the borehole. Obviously the measuring apparatus must be confined to the borehole. The conductive mud and mudcake in the borehole will tend to short out the signal; therefore, means must be provided to minimize this "hole effect." And, before any technique can be worked out, we need to know how far back from the borehole to measure to reach the low zone and beyond. These problems will be taken up one at a time.

One might think that the depth of invasion would increase significantly with time. However, this is true for only a short time after the formation is drilled. As mud filtrate invades a porous zone, mudcake builds up on the walls of the borehole. The mudcake is relatively impermeable and, therefore, the total amount of invading fluid is practically limited to a small and constant value for a given mud.

In a very porous formation the total available mud filtrate can be accommodated in the pore space within a few inches of the borehole. Consequently, in very porous zones the low zone will be within a few inches of the borehole. In a low porosity limestone the same volume of mud filtrate must invade out to a distance of one or two feet in order to be accommodated in the limited pore space. With a high fluid loss mud the invasion might extend many feet back into a low porosity zone. The distance of the low zone from the borehole will then vary from a few inches to many feet.

The next problem is to devise a means of detecting changes in the resistivity at various distances from the borehole ranging from about two inches to about three or four feet. One possible means would be to make successive electrical measurements of resistivity by some means which would effectively penetrate progressively farther back from the borehole. The first few measurements should effectively measure the resistivity of that part of the invaded zone which contains mud filtrate and residual oil. The next few measurements should be influenced significantly by the low zone containing salt water and residual oil if this zone is present. The final measurements should effectively measure the resistivity of the virgin formation.

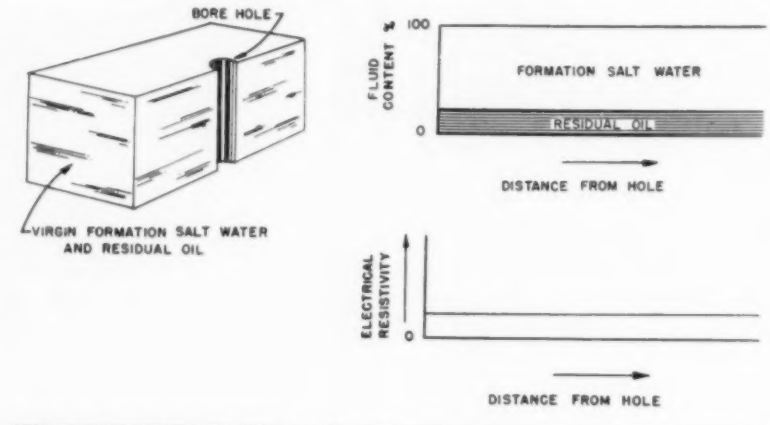


FIG. 3. **Water zone before invasion.** Resistivity does not vary.

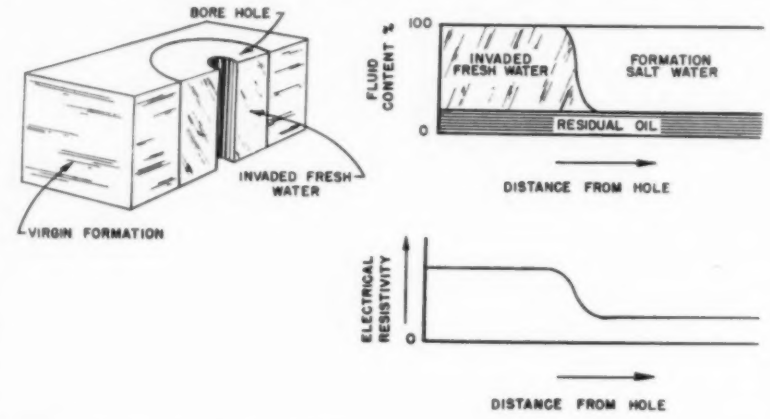


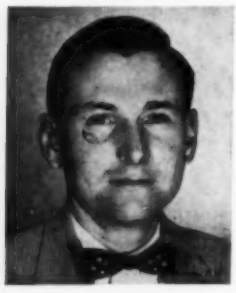
FIG. 4. **After invasion** of mud filtrate into water zone. No low resistivity zone separates invaded zone and virgin formation.

Limiting Measurement

There are two means for limiting the depth of penetration of the measurements. The preferred technique using variable electrode spacing will be discussed later. Another possible technique would employ a single fixed electrode spacing, but the frequency of the applied current would be varied from a high frequency down to an audio frequency. The penetration of current away from the borehole would be limited by an effect commonly called "skin effect."

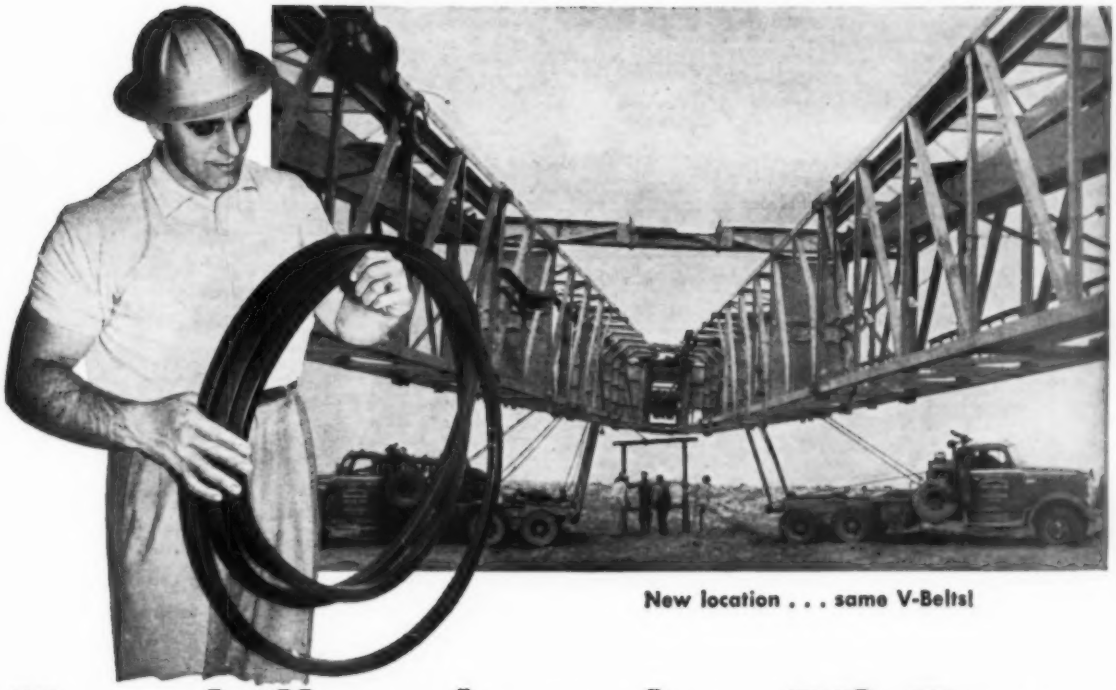
One disadvantage of this technique is that the penetration of current would depend not only on the frequency but also on the resistivity of the formation being tested.

The simpler, and consequently preferred technique, would employ a single current frequency with an increasing electrode spacing. The frequency used must be low enough to allow effective penetration of current



The Author

W. C. Pritchett *is presently in charge of developing the technique known as displacement logging at The Atlantic Refining Company's Crude Oil Production Research and Development Division in Dallas, Texas. Pritchett holds a BS degree in electrical engineering from the University of Colorado (1946) and the MS in electrical engineering from the University of Texas (1948). Since 1948 he has worked for Atlantic in the production research and development division in Dallas. Prior to his present assignment, he worked on various surface exploration projects and has written two technical papers in this field.*



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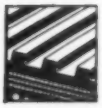

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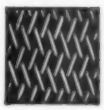

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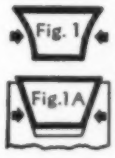

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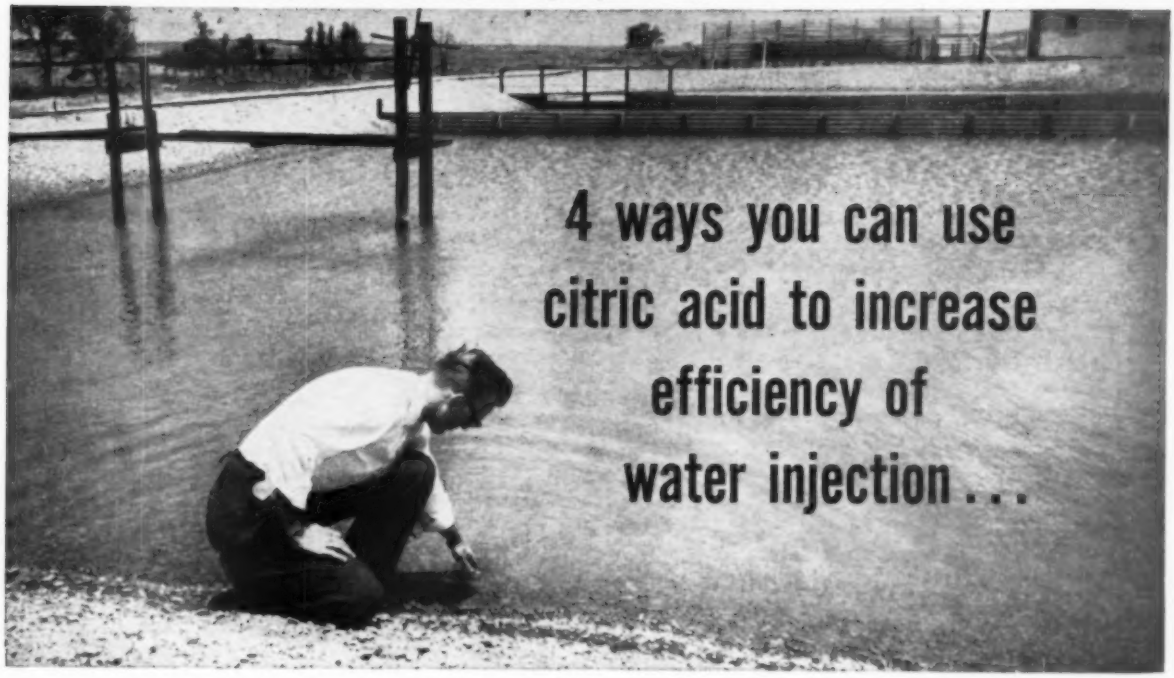

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1. Maintenance Treatment entails the constant addition of citric acid (3:1 or 4:1 ratios of citric to iron content) to prevent iron from filtering out on the sand into which the water is injected. This, of course, helps to maintain high injection rates at normal pressures. For best results in maintenance treatment with citric acid, a water injection plant should be operating at optimum injection rates and pressures.

Two salt water disposal wells in southern Texas, with average injection rates of 200 to 400 barrels per day showed a 30 percent increase in injection shortly after only 8 ppm addition of citric acid was started as maintenance treatment.

2 & 3. Acidizing and Detergent Treatments are very important adjuncts to successful maintenance treatment. When iron plugging the sandface has already caused lowered rates and/or high pressures, acidizing with citric and hydrochloric acids or cleaning with detergents plus citric acid are excellent methods for returning the injection wells to optimum conditions.

A well in Oklahoma showed marked improvement after acidizing with a solution of 260 pounds citric acid, 25 gallons Triton* X-100, 250 gallons 15% hydrochloric acid and 500 gallons water. The injectivity index rose to 195 bbl./day/ft. of pay from 3 bbl./day/ft. of pay. Gradual decline was noted over a short period, but the index leveled at 80 bbl./day/ft. of pay.

4. Slug Treatment with citric acid is designed for those systems where the water contains iron which cannot be economically treated to keep the iron in solution, or for those systems where the iron is completely precipitated before the water can be treated. Slug treatment at 500 ppm once every 4 to 6 weeks sufficiently lowers the pH to dissolve much of the insoluble iron, and the cost of treatment is low when averaged over this period of time.

A well in southern Louisiana was treated by slugging with two 400-pound batches of citric acid, two weeks apart. Injection rates have more than doubled, from 4,000 to 8,640 barrels per day, at last report, and in addition, the pressure has averaged 300 psi lower than previous requirements.

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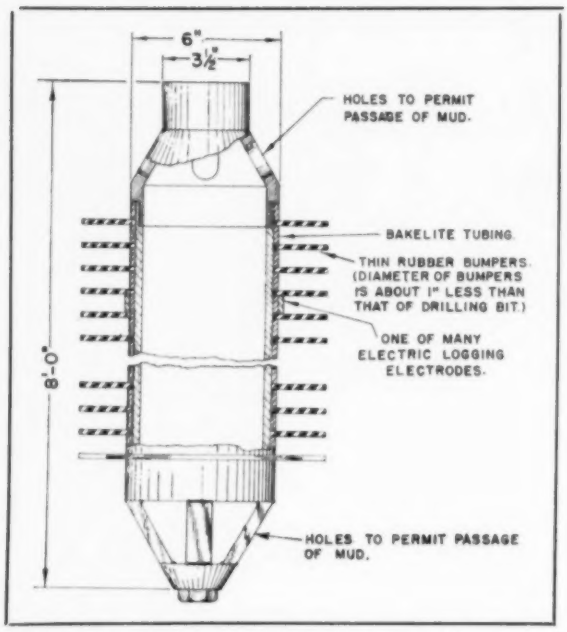
6"
3½"
HOLES TO PERMIT PASSAGE OF MUD.
BAKELITE TUBING.
THIN RUBBER BUMPERS. (DIAMETER OF BUMPERS IS ABOUT 1" LESS THAN THAT OF DRILLING BIT.)
ONE OF MANY ELECTRIC LOGGING ELECTRODES.
8'-0"
HOLES TO PERMIT PASSAGE OF MUD.

FIG. 5 **Displacement logging sonde** with circular rubber bumpers to minimize shunting effect.

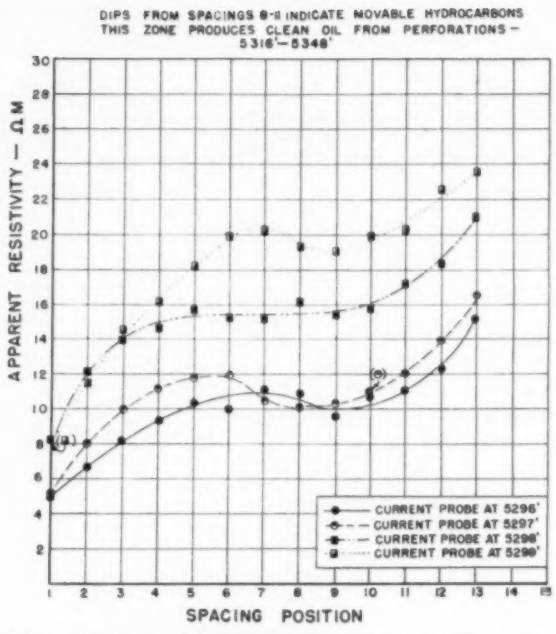
DIPS FROM SPACINGS 8-II INDICATE MOVABLE HYDROCARBONS
THIS ZONE PRODUCES CLEAN OIL FROM PERFORATIONS — 5316'—5348'
APPARENT RESISTIVITY — Ω M
SPACING POSITION
CURRENT PROBE AT 5296'
CURRENT PROBE AT 5297'
CURRENT PROBE AT 5298'
CURRENT PROBE AT 5299'

FIG. 6. **Displacement logging results** in wells in the Sholem Alechem field, Stephens County, Oklahoma. Profiles in oil bearing zones.

out to at least three feet even in formations which have very low resistivities. The shortest spacing should effectively limit the measurements to the near portion of the invaded zone. The next few longer spacings should allow the measurements to be significantly affected by the low zone. The still longer spacings should measure the resistivity of the virgin formation.

Variable Electrode Spacing

One additional means of measuring the resistivity at various distances from the borehole would be to make an induction type log. By using focusing coils one could theoretically investigate variations in the resistivity at various distances from the borehole. One means of varying the focusing might be to vary the position of one or more of the coils. This technique would then become a modification of the previously discussed technique of varying the electrode spacing.

Normal measurement. If we pursue the variable electrode spacing technique, we must decide what type of electrode configuration to use. The simplest system would be to make a "normal" measurement using one current and one potential electrode downhole with the other electrodes at the top of the hole which is effectively at infinity. However, the relatively thin low zone would not have a very significant effect on a series of normal measurements.

A lateral measurement is approximately equivalent to the derivative of a normal measurement. A minimum or an inflection in a normal measurement would be replaced by a more obvious event in a lateral measurement. A series of lateral measurements would then be more significantly affected by a low zone. A lateral measurement requires three downhole electrodes with the other electrode at infinity. The lateral measurement yields a smaller signal than the normal but the signal is large enough to be measured easily.

The differential lateral log is effectively the derivative of the lateral log and would further enhance the relative effect of the low zone on the measurements. The signal level would be still smaller and rather hard to measure. Also, four downhole electrodes would be required which would make it more difficult to vary the spacing. It seems probable that most of the commercial oil zones occurring in sandstones could be detected using a series of lateral measurements. The spacing should vary from a few inches to six or eight feet.

Shunting Effect

The remaining problem is to minimize the shunting effect of the borehole. Whereas the mud is relatively fresh, the 100 percent porosity of the hole results in a low resistance. The problem is particularly acute when the formation resistivity is quite high. Linestones frequently have low porosity, deep invasion and thin layering which accentuate this problem.

One technique which has been tried for overcoming this difficulty is to use a series of circular rubber disks which are only slightly smaller in diameter than the diameter of the hole. Fig. 5 is a sketch of a sonde with the bumpers mounted horizontally so as to interfere with the vertical flow of current in the hole. The mudcake on the side of the hole along with the mud outside the bumpers will tend to mask partially the effect of the low zone. Because of the hole effect the apparent resistivity will be reduced for the shortest spacings at least.

Field Results

A number of displacement logs have been made in wells in Oklahoma and Texas. Low zones were detected in a number of known oil bearing zones and one or two new commercial zones were first pointed out by this tool. The sonde used employed a series of lateral measurements with rubber bumpers to minimize the hole effect.

Fig. 6, 7, and 8 show plots of the apparent relative resistivity as a function of the electrode spacing. The plots are called "resistivity profiles." Fig. 6 shows some resistivity profiles measured in an oil bearing formation. The low zone is indicated quite clearly in these profiles by a definite minimum. Fig. 7 shows some resistivity profiles measured in water zones. The absence of a minimum confirms that these are water zones. Fig. 8 shows some resistivity profiles in low porosity oil zones. Here the hole effect seriously alters the shape of the profile but the low

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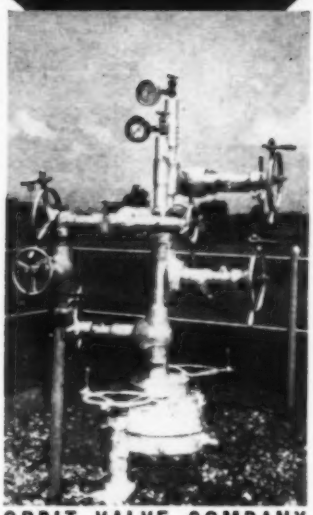

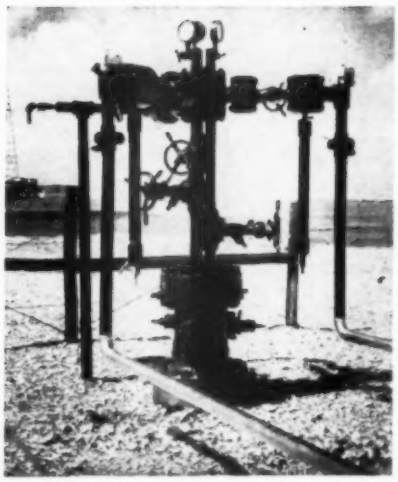

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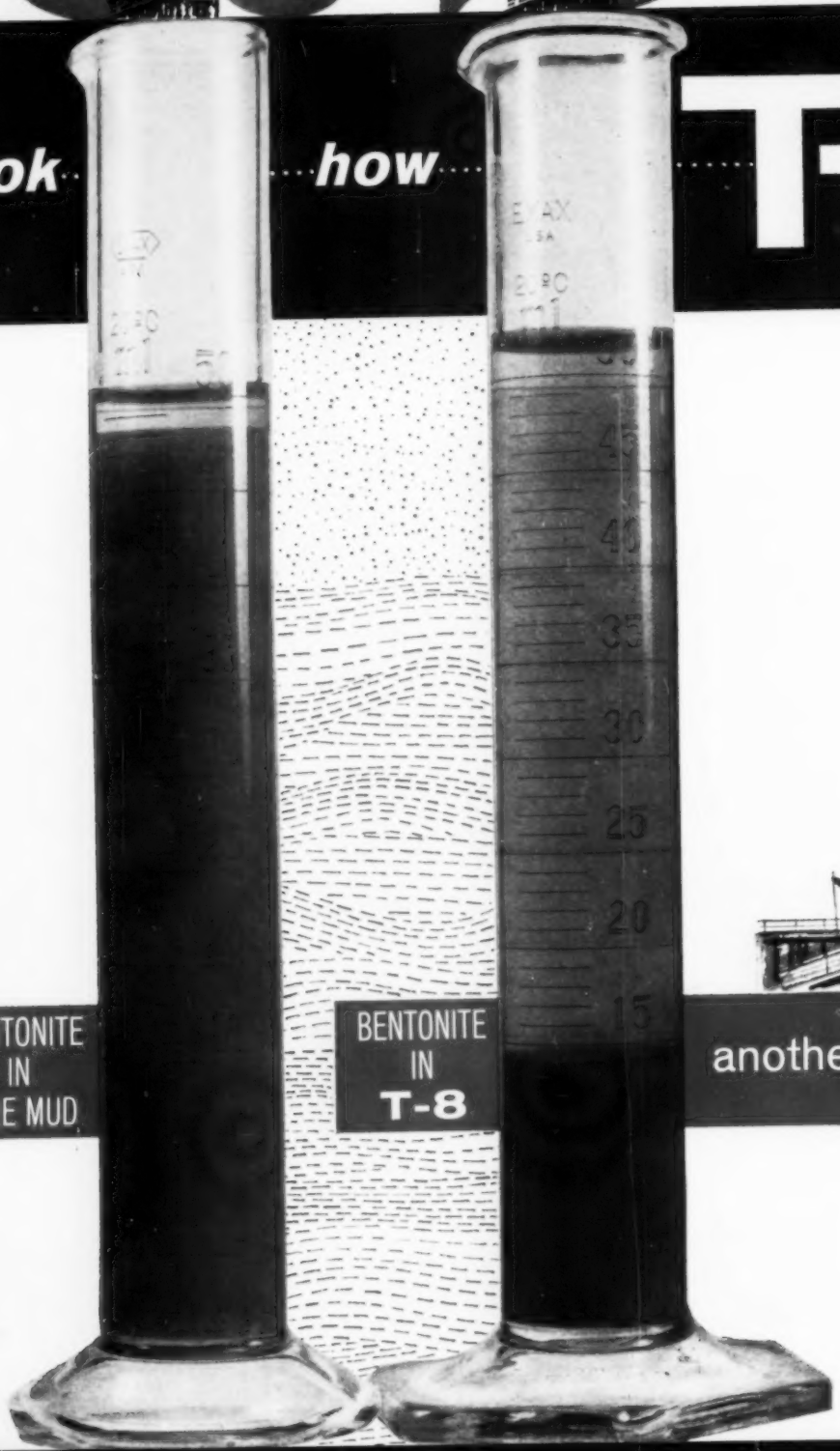

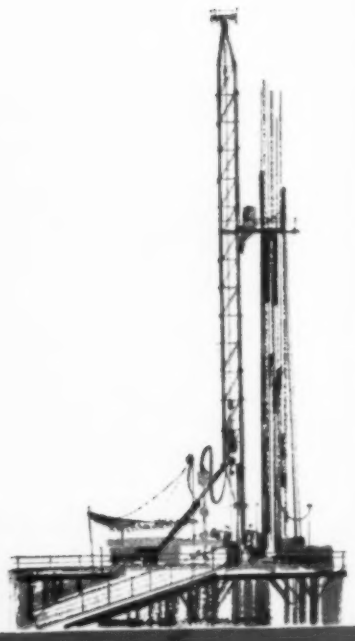

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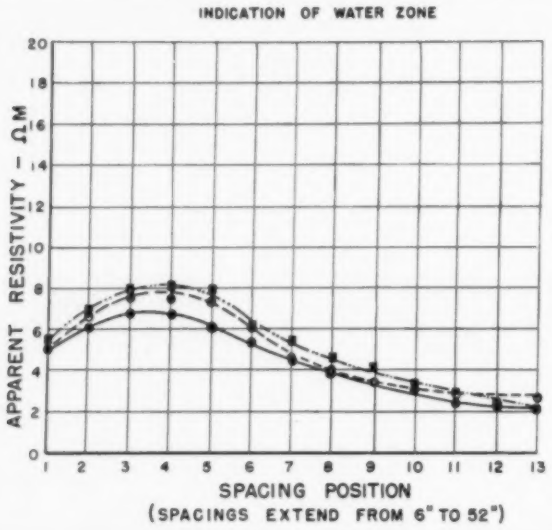


FIG. 7. **Displacement logging results** in wells in Sholem Alechem field, Stephens County, Oklahoma. Profiles measured in water zones.

zone is still detectable by at least a pronounced inflection in the profile. In low porosity water zones the profile is similar except that the inflection is not present and the profile is simply a rising curve which may or may not begin to saturate at the longer spacings.

As was previously explained, the invasion depth is limited by the build up of mudcake. The low resistivity zone will be developed in the outer part of the invaded zone. The question might arise as to how long the low resistivity zone will exist before it is destroyed by a mixing of the saline water with the mud filtrate. This mixing might occur as a result of the difference in density. Or the low zone might be destroyed by diffusion of the ions of the salts or by inbibition. Fig. 9 shows two resistivity profiles of a sand core initially containing oil and irreducible salt water. Some relatively fresh water was injected in one end of the core. One profile was measured after the simulated invasion of mud filtrate. The other profile was measured 13 days later. These data indicate that the low resistivity zone will persist for a reasonable period of time after a formation is drilled.

Field Tool Needed

The theory of the displacement log has been proved. Some field success has been experienced primarily with a research type tool which would not be practical for commercial field use. Until a practical field tool is developed, this intriguing technique is a technical success but an economic failure. We are working on a fast, accurate tool which will yield essentially immediate results. The results must be in a form that is easy to interpret. Then the data can be used to answer the pressing question of which formations, if any, should be tested. With such a tool a proved "dry" hole can be plugged with a good deal less of that gnawing feeling that it might contain black gold. But the real triumph will be when an unsuspected zone yields an indicated low zone on the resistivity profile. If subsequent tests bring in a good reservoir, then the technical success will become an economic success as well.

Acknowledgment

Much of the work reported here has been covered in more detail in a paper by W. M. Campbell and J. L. Martin which was published in the *Transactions* of the AIME, 204 (1955) page 233. The sensitivity of several methods of detecting low zones of various resistivity contrasts and geometry was investigated by Hubert Guyod, Houston Logging Consultant, by use of his resistivity analog model. A basic patent (No. 2,782,364) on the displacement log has been granted which is assigned to The Atlantic Refining Company. ★

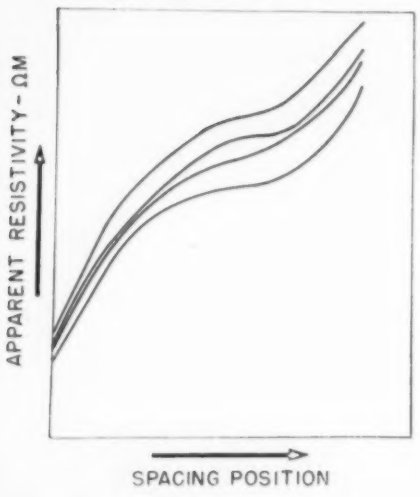


FIG. 8. **Field displacement logs** in low porosity oil zones.

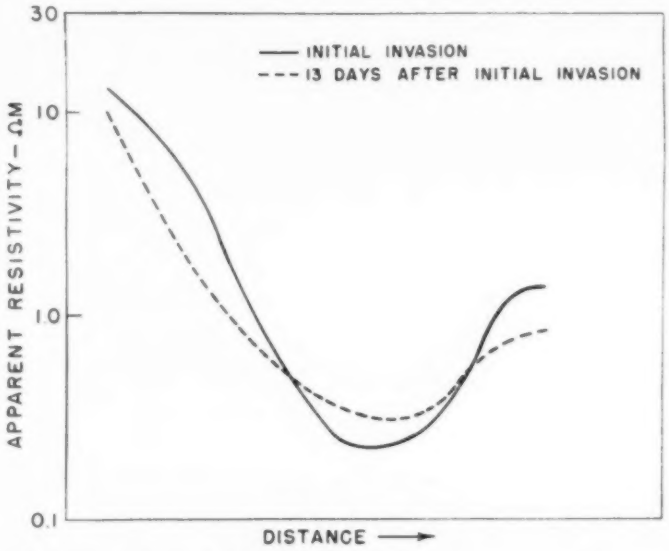
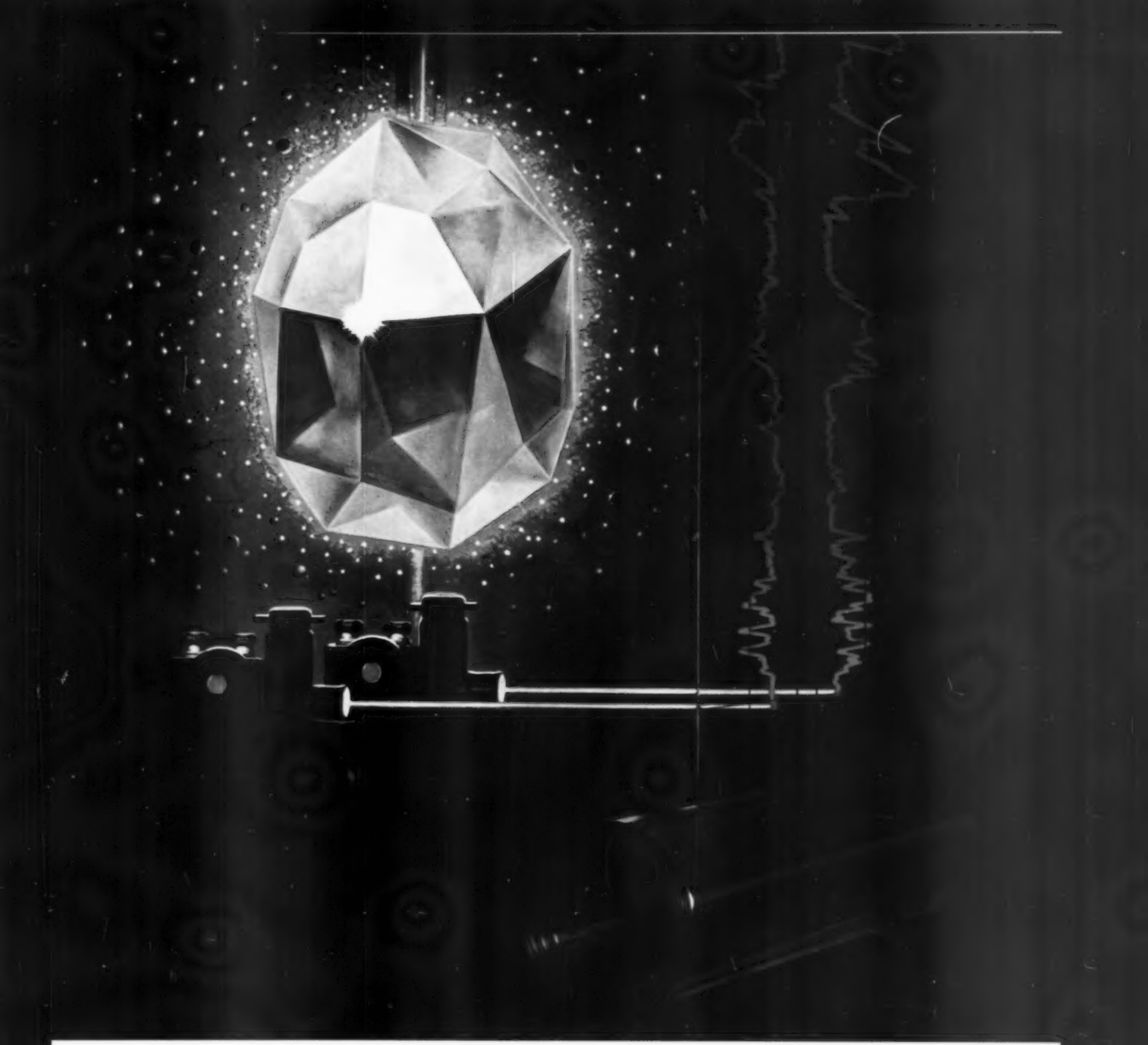


FIG. 9. **Resistivity vs distance** along sandstone core.



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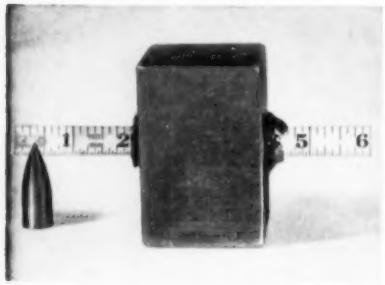

Illustration above shows a 2½" steel test sample pierced by an improved ½" Ogival Bullet fired by a McCullough M-3 Bullet Perforator.

McCullough Sectional Gun Gains Penetration Where Previous Attempt Failed

Depth of operation was only 1487' 4½" O.D. casing had been cemented in 10¾" hole. Pay zone was bullet perforated by another service company but the formation would not break down. During the attempt to fracture, the pipe split above the zone and collapsed in the perforations.

Operator swaged out the 4½" casing, ran a 3" liner inside the 4½" and cemented the annulus. This operation made an impressive amount of steel and cement to be penetrated to gain production.

McCullough shot 20 improved ⅜" Ogival Bullets in the zone and the formation broke down at 800 lbs. Time on the job was one hour. Results, a good well and a satisfied oil man.

McCullough Sectional Guns are available in 1⅜" O.D., 1¾" O.D. and 2¼" O.D. sizes.

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Hard Shooting M-3 Guns, Firing Improved Ogival Bullets, Gain 38 B/D Over Previous Jet Perforating

An excellent example of the penetrating power of McCullough M-3 Bullet Guns was recently reported from a California oilfield.

This was a shallow, low production field. The well had previously been perforated by another service company with shaped charges for a settled production of 12 barrels of oil per day.

Productive interval lay between 3837' and 3872' and was cased with special 7" O.D. 51 lb. casing. Casing was cemented in 9¾" hole through the pay zone.

Although skeptical of the ability of any bullet perforator to gain effective penetration through the extra heavy casing and thick cement sheath, the operator called for McCullough M-3 Bullet Guns.

McCullough Service Crew made three runs with 4¾" O.D., 20-shot M-3 Guns, firing 140 improved ½" Ogival Bullets, four per foot, in the 35' zone.

Production increased from 12 to a settled 50 barrels of oil per day—a gain of 38 barrels. The job required two hours, including rigging up and tearing down. To quote the operator, "Results were very satisfactory and gratifying".

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Two strings of casing had been set through the pay zone at 5587'—5590'. 5" O.D. 18 lb. liner was cemented in 7⅝" O.D. 28 lb. casing which, in turn, was cemented in 11¼" open hole.

A 3½" O.D. McCullough M-3 Gun fired 18 improved ½" Ogival Bullets in the three foot pay zone. Operator stated he is satisfied it is his best completion to date.

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A new Burrless Bullet Cap, if desired, is inserted over the point of the improved Ogival Bullet at the time the M-3 Gun is loaded. It provides a completely burr-free hole on the inside surface of the perforated casing. Symmetrical, smooth holes make the use of ball sealers more effective in acidizing and sand fracturing—assuring more complete perforation shut-off.

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Argentine Activity Hits Feverish Pace

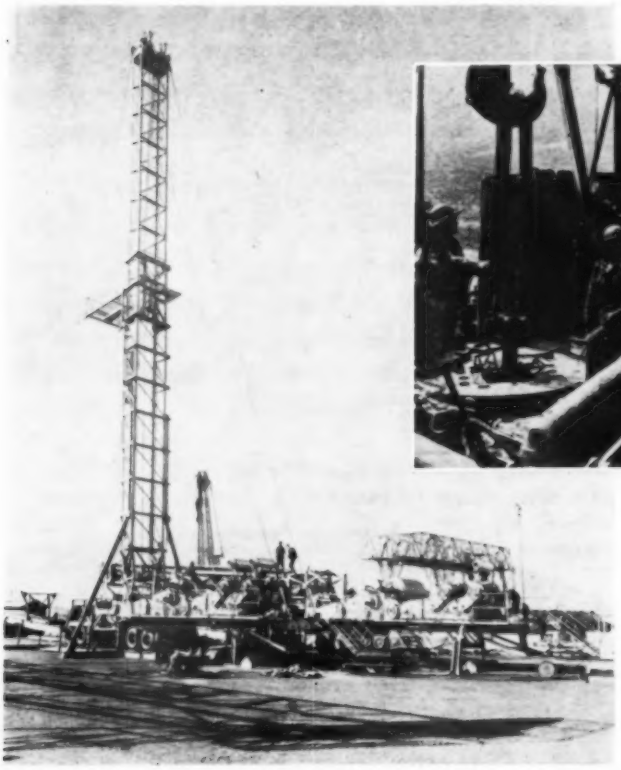
Additional rigs arrive in Comodoro Rivadavia area to help meet rising oil demand in a dollar-short economy

EFFECTS of Argentine President Frondizi's plan to make his South American country self-sufficient in oil are becoming more evident as drilling equipment manufactured throughout the world takes positions at locations in Argentina.

Most recent of the significant developments is the delivery from Italy of the largest number of identical drilling rigs ever destined for one area. When the order is complete, 30 identical rigs will be at work in the Comodoro Rivadavia area drilling for Yacimientos Petroliferos Fiscales, the national oil company. Twenty of the dual trailer-mounted rigs are being shipped from Italy. Ten exact duplicates were shipped from a Beaumont, Texas, plant in 1957. This order for new drilling equipment is just one phase of Argentina's crash program to fill the country's rising oil needs from domestic reserves.

Foreign Aid

Until 1958, the Argentines had tried to build oil production through the



Fast, mobile trailer-mounted rigs, such as these two at left, are fast replacing obsolete equipment, above. New rigs are a portion of an order for 30 identical dual-trailer mounted units for use in the Comodoro Rivadavia area, shown here in an Italian manufacturing yard. Ten were made in the U. S., 20 in Italy under U. S. license. Photo above was taken in Comodoro Rivadavia area.

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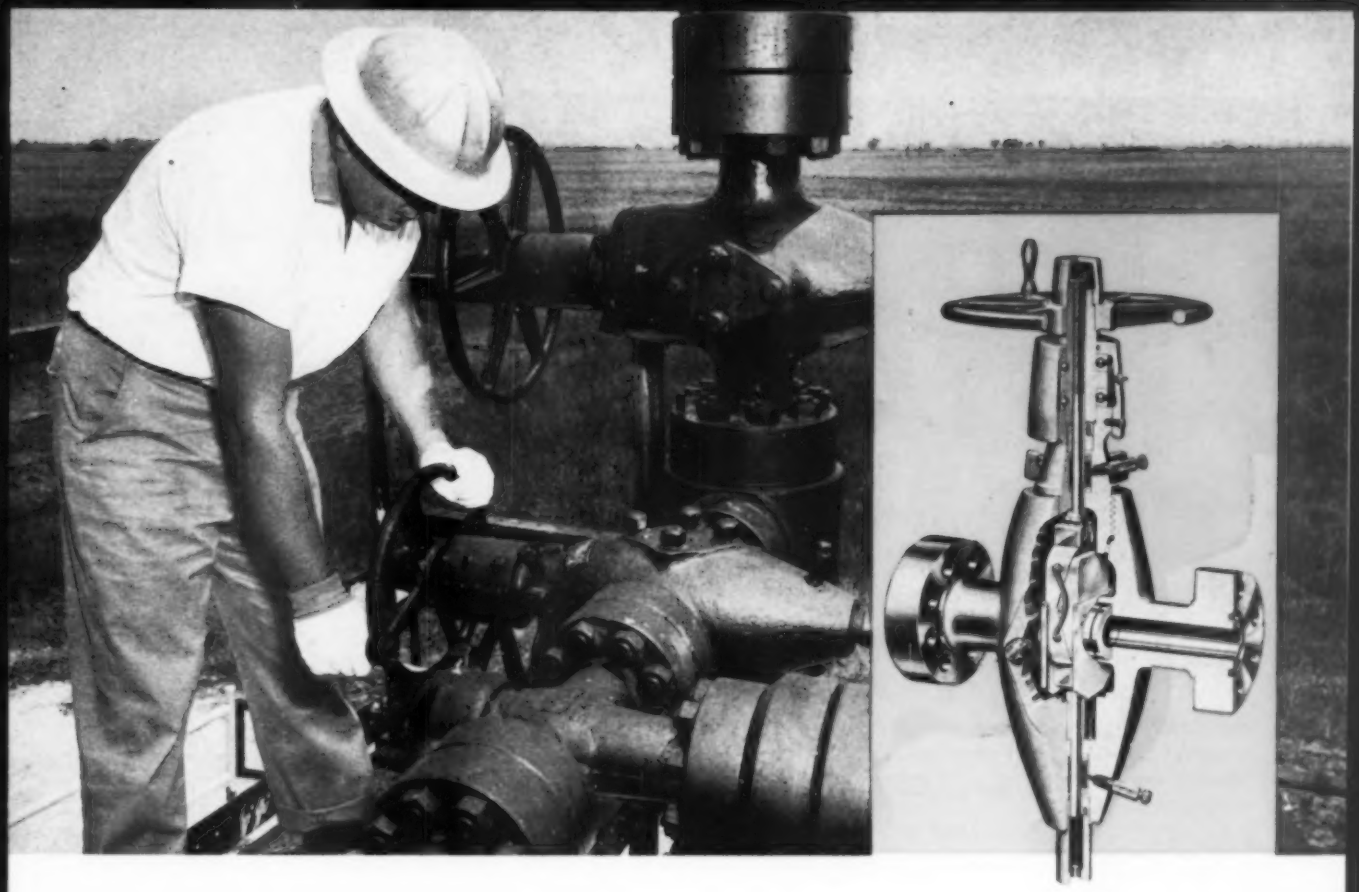

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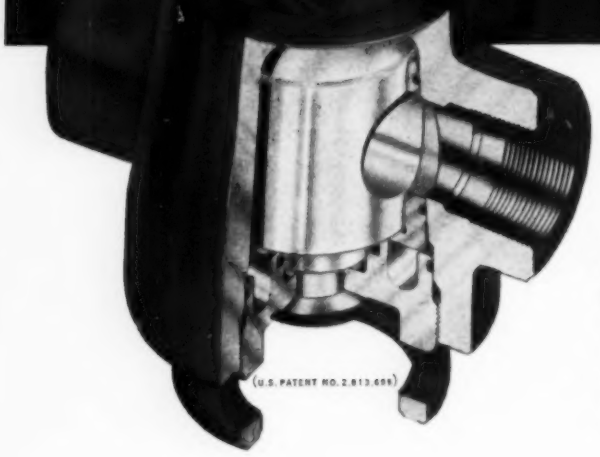

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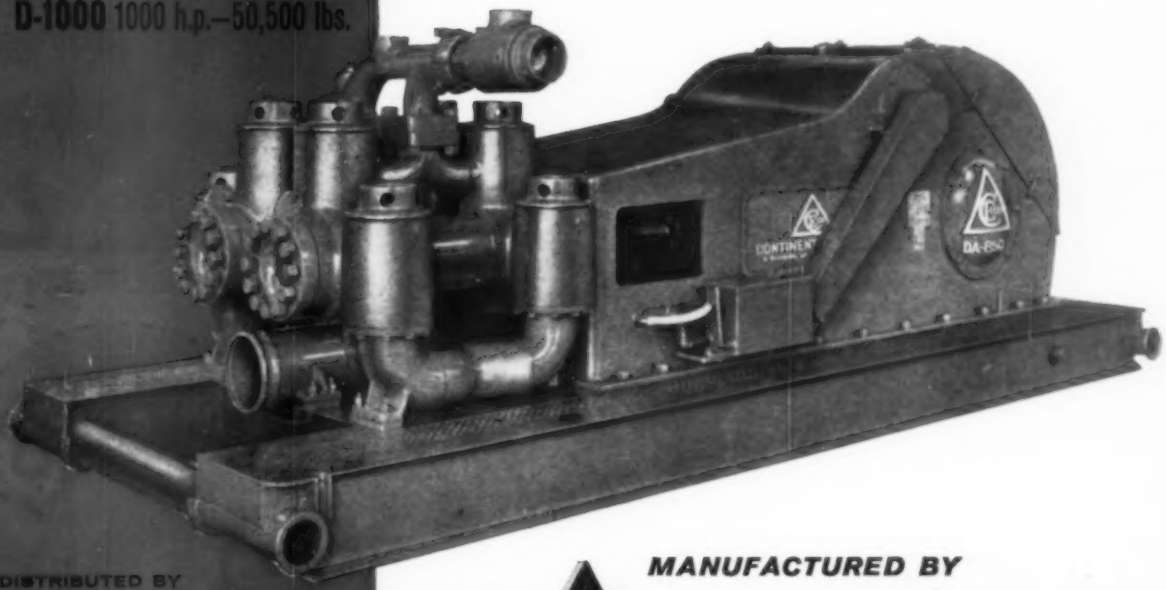

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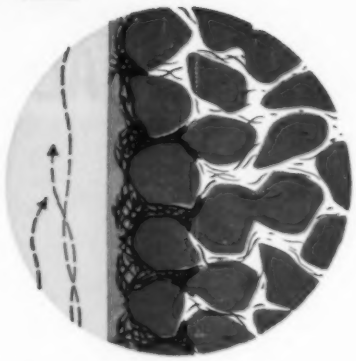

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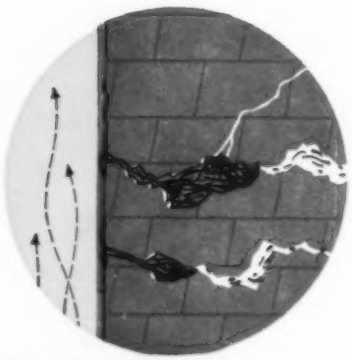

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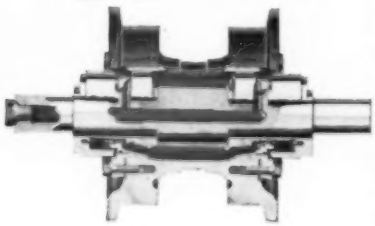

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efforts of the state oil company, YPF, although a few private firms have some production on long-standing small concessions. Production from all sources, however, did not meet the fast-rising demand. As a result fuel imports rose, thereby draining dollars from the Argentine economy.

In the last five years fuel imports, including coal, averaged 21 percent of the country's total imports, or double those in the 1930's when three-fifths of its energy consumption was met from domestic resources, as compared with less than one-half at the present time.

The now deposed President Peron set a target for petroleum production under a second five-year plan (1952-57) at 45,000,000 bbl by 1957. Although the crude output increased nearly one-third during that period, the 1957 output totaled only 40,500,000 bbl. Imports, on the other hand, rose nearly as fast by one-third to 60,000,000 bbl. In January-November 1957, fuel imports cost Argentina $291,200,000 or half as much again as in 1955.

Reasons for the delay in expanding domestic oil production are partly political and in part technical. The financial problems involved were greatly underestimated. Early in 1956 the government expected to be able to achieve oil self-sufficiency by 1961 without allowing any extension in the activities of foreign oil companies. Subsequent more modest expectations envisaged a doubling in petroleum output to around 82,500,000 bbl in 1961 — when consumption is expected to reach 120,000,000 bbl.

Two years ago, Argentina's known crude oil reserves were no more than 90,000,000 bbl and it was on that basis that UN expert Elliott, engaged by the government after the downfall of Peron, advised in favor of the development program underway.

The provisional government of General Aramburu which followed Peron did little to formulate a definite oil policy. President Frondizi, who took office in May 1958, realized the need for some type of foreign aid.

In keeping with strong nationalist feelings within the country, the oil policy took several patterns consisting of a variety of contracts and proposals which would permit Argentina to displace foreign oil with that produced domestically. This in effect will achieve a reduction of current foreign exchange outgoings per ton of oil, but for some time may entail foreign exchange disbursements. As an emergency measure overseas assistance involving work and supplies valued at nearly a billion dollars was arranged and YPF was reorganized as an instrument of the state to fulfill the program set out.

Comodoro Rivadavia wells extend into the Atlantic. Oil production in this area dates back to 1904 and the many fields in the immediate region are fast depleting. Offshore are crude-carrying tankers being loaded for use in one of Argentina's 18 refineries.

Among the most important of the several contracts signed and pending is that with a consortium made up of several American corporations and one German supplier. The contract is valued at the equivalent of $700,000,000 and is spread over a 6-year period. It calls for drilling 4000 wells in the Comodoro Rivadavia area; the possible construction of a 26 to 30-in. gas pipeline from the field to Buenos Aires with a lateral to Plaza Huincul and the supply of crude oil; also, a plant for fabricating oil equipment is to be set up.

A second contract is a 20-year contract with Carl M. Loeb, Rhoades & Company, who will finance about $100,000,000 of equipment and work in an area not yet decided upon.

Pan American International Oil Company and YPF signed an agreement in August covering development and operation of certain areas of YPF in the Comodoro Rivadavia area.

The agreement covers three structures in the provinces of Chubut and Santa Cruz, Anticlinal Grande, known as Sarmiento, Cerro Dragon and Canadon Grande, on which YPF already has production.

The contract, which is for 15 years with an option for an additional 5 years, requires Pan Am International to develop these areas to the fullest extent and as rapidly as possible. Fifty wells will be drilled within the first year, 10 of these in the Sarmiento area and 40 in the Cerro Dragon area. Depending on the success of the first year's program, the Indiana Standard subsidiary will drill an additional 100 wells in the second year, and build a pipeline. Pan American will assume the entire risk in the undertaking and will provide the funds for all drilling, development and construction.

Thirty wells will be drilled in the next two years in the Comodoro Rivadavia area under an agreement between YPF and Astra Compania de Petroleo S.A., a domestic private producing company. The wells will be at sites picked by YPF in the Manantiales Behr and El Tordillo areas, about 40 km from the town of Comodoro Rivadavia. Astra is one of the companies which has held a concession for several years. Its peak production, all in the Comodoro Rivadavia area, reached a peak of 3500 bbl per day in 1950, but has now declined to about 2000 bbl per day. Astra has been in this region for 42 years.

Other firms interested in developing Argentina's oil and natural gas resources under the YPF auspices include: Petrofina, S.A.; Sea Drilling Corporation of Louisiana; Conorada Petroleum (Conoco, Amerada and Ohio Oil); Conferro S. A. (German-Swiss group headed by Durum A.G. of Zurich); Astra; a French group (Institut Francaise du Petrole, Impex and Schneider), and Union Oil of California.

Although YPF has no monopoly in oil production, nevertheless, ever since 1935 it has been impossible for private companies, local or foreign, to obtain new concessions. So much so, Jersey Standard, Royal Dutch-Shell, Astra and "El Sosneado" are near to exhaust-

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DRILLING CONTROL *for* MEDIUM SIZED RIGS

The MARTIN-DECKER

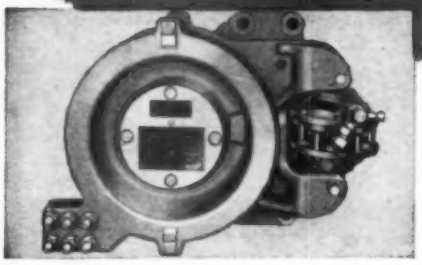
LOW COST

TYPE "FS" WEIGHT INDICATOR

NOW equipped with the Famous

* SENSATER

for greater accuracy and sensitivity



MARTIN-DECKER *is now offering the Type "FS" Weight Indicator with the famous Sensater replacing the piston as the sensing element. This gives the "FS" all the advantages of its bigger brothers—the "E" and "D" Weight Indicators.*

THE SENSATER realizes every weight change no matter how small and relays it instantly to the Indicator mounted conveniently in front of the driller. At medium depths small weight changes are very important and must be known for best operation. It is in the medium range that competition is extremely strong and footage rates cut to the barest margin of profit. A rig operator cannot afford any unnecessary loss of time and must make the best use of all drilling time. The Type "FS" is the best insurance against lost time due to fishing jobs, giving him quick and better recovery. The sensitivity and accuracy in this instrument will give the best use of all drill collars run . . . and faster, better hole.

The anchor installation provides a quick, easy method of slipping the line and because the Sensater is an integral part of the anchor there is no need to move the pressure transformer during the operation — thus preventing one of the major causes of Weight Indicator damage.

The indicator has a net weight on bit pointer and dial that is extremely helpful to the driller in maintaining a constant bit weight. Experience has shown this instrument to be accurate and dependable for many years of trouble-free operation.

THE ANCHOR—The Type "FS" Wire Line Anchor is manufactured by the National Supply Company. It is similar to the "E" and "D" anchors with the exception of being lighter, smaller and designed for side mounting. It provides a simple, convenient method of slipping the line and does not require the removal of the Sensater.

THE SENSATER — The Sensater sensing element in the "FS" is a smaller edition of the one incorporated in the "E" and "D" instruments and offers all the advantages of the larger cell. This new addition to the "FS" instrument makes it even more attractive to the operator who desires a sensitive, accurate weight indication at low cost.

THE GAUGE — The Type "FS" gauge is equipped with a total load pointer and a four-to-one vernier pointer for extra sensitivity. There are also two dials: the inner dial, reading in pounds or kilos, for the total load and the outer dial is adjustable to enable the operator to read the weight on the bit or the net pull on the pipe when fishing or in a tight hole.

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Write For Descriptive Literature

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Martin-Decker Weight Indicators and National Wire Line Anchors are sold through the Reed Roller Bit Company, the National Supply Company, and other recognized supply houses, as well as by the Martin-Decker Corporation, 3431 Cherry Avenue, Long Beach 7, Calif.

ing their oilfields. Their share of the slowly expanding national output has fallen from about one-half in the 1930's to less than one-sixth at the present time.

In the all-out, overnight drive to bring about a spurt in oil production, YPF's policy seems to place first preference on bolstering flow within and near existing oil fields. A second factor upholding this policy is the lack of crude pipelines; field development and pipelining takes time — additional oil near existing facilities keeps costs and pipeline construction time down.

Oil-Producing Areas

The country's main oil-bearing districts have been known for many years, but their exploitation was held up for various reasons. Oil was first discovered in 1904 near the sea at Comodoro Rivadavia, and in 1924 at the foot of the Andes in the province of Neuquen. The Neuquen producing areas are larger and yield better quality oil; but they have not been so fully developed because of transportation difficulties.

Approximately half of the nation's proved reserves lie in these two areas, accounting for 75 percent of its oil production. The pioneer oilfield at Comodoro Rivadavia is nearing exhaustion. The other two producing districts in the province of Mendoza due west of Buenos Aires and in the province of Salta near the Bolivian Border.

All but one of the finds in post-World War II years have been in the vicinity of these four fields.

In 1945 oil was found near the port of Caleta Olivia, 50 miles south of Comodoro Rivadavia. Much of the increase in Argentina's output has come from this field because of its accessibility. In 1950 oil was discovered on the island of Tierra del Fuego. Although little oil has been produced, YPF has awarded a $6,160,000 contract to Laughlin-Porter Drilling Company, working with Ecofisa, a domestic concern, for drilling 40 wells.

The most important discoveries, which could overshadow all others if transportation problems can soon be solved, were those at Campo Duran in 1951 and Madrajones in 1953, both in the province of Salta. Wells at Campo Duran produce at the rate of 950 bbl per day with about 7,000,000 cu ft of gas. Because of the lack of pipelines and gas processing plants, waste has been high and pressures have been lowered somewhat. Oil production from the Andean fields must come to the coast via rail — which has to no small extent hampered their development.

As can be seen, due to lack of existing pipelines and plans in progress, much of Argentina's oil dollar is being spent in the coastal producing area near Comodoro Rivadavia.

ARGENTINA — PRODUCTION AND DRILLING, 1957

Company	Oil production in bbl	No. of Wells Completed	Footage Drilled
YPF	29,285,542	300*	1,728,000*
Diadema Argentian S.A. de Petroleo	2,963,697	13	59,584
Astra Compania Argentina de Petroleo	740,000*	†	†
Petroguimica	575,000	†	†
Esso S.A. Petrolera Argentina	296,948	2	2,299
Compania Rio Antel "El Sosneado"	3,396	†	†
Total	33,854,583	315	1,789,883

* — Estimated.
† — Figures not available.

YPF Oil Production by Provinces and Districts, 1957

Province	District	Oil Production in bbl	No. of wells producing
Mendoza	Mendoza	9,039,701	187
Santa Cruz	Canadon Seco	7,728,686	*
Chubut	Comodoro Rivadavia	7,632,421	2,113
Neuquen	Plaza Huincul	4,140,204	349
Salta	Narte	744,531	109
Tierra del Fuego	Tierra del Fuego	—	—
Total		29,285,542	2,758

* — Figure not available.

The Comodoro Rivadavia fields produce 24.5 deg API crude from several Cretaceous sandstone formations ranging in depth from 2900 ft to 6900 ft. Nearly 100 percent of the estimated 2100 wells in the fields in this area are artificially lifted.

Of the more than 80 rigs now in operation in Argentina, most of them are concentrated in the Rivadavia region. When present orders for rigs are fulfilled, YPF and other companies will be running 100 rigs; the optimum number, as predicted by YPF, will come in the next few months.

Many obsolete rigs may soon be retired for the newest, fastest and most mobile drilling units available anywhere.

The 30 identical trailer-mounted rigs being assembled by YPF at present were chosen to meet fast shallow to medium depth drilling needs and quick, uncomplicated moving outside the range of rig-moving specialists in the truck contractors fields as exist in the U. S. Argentina's "La Razon" newspaper credits the new American designed rigs with reducing rig-up time to one-fourth the previous requirement and completing wells in an average of 15 rather than the usual 45 days.

These rigs are fitted with telescoping internal-guyed mast, rotary table, substructure, pipe ramp, cat walk, traveling block with permanent string-up, and a reel with extra drilling line — all on the mast trailer. On the drawworks trailer is the driller's control panel, with remote controls to pumps, double-drum drawworks driven by two 248-hp diesel power units through a two-shaft chain compound. Two unique devices are built into the trailers to speed rig-up. A gooseneck lifting system at the forward end of each trailer employs reeved sheaves on a hinged frame to elevate the trailer as much as 18-in. for leveling purposes. The pipe ramp-walk is also hinged at the substructure permitting it to be dropped to a 4-ft working level. With each rig is a 600-hp duplex mud pump and torque-converter-equipped diesel engines unitized on skids.

Ten other new rigs are enroute to the Comodoro Rivadavia area for Loffland Brothers, Tulsa, Oklahoma, drilling contractors, engaged to fulfill Pan American International's drilling commitment in Argentina.

Late in September 1958, Union Oil Company of California signed an exploration contract for 20 years with YPF in a 6250 sq mile area lying west and north of proved areas in the Comodoro Rivadavia fields.

Near the end of 1958 affiliates of Jersey Standard and Royal Dutch-Shell were reported near the signing stage of drilling contracts with the Argentine Government. It has been reported that the contracts involve investments of $200,000,000. The immediate companies involved are Shell Cia. de Argentina, and Esso Petrolera Argentina, both long established but for many years stymied for lack of new concessions to develop.

Production Rise

Effect of the accelerated drilling is beginning to register a change in statistics. According to official figures, crude oil production has now (August 1958) reached a daily figure of 81,398 bbl per day, against 66,841 bbl per day in 1957 and 59,463 bbl per day the year before. As soon as transportation difficulties are overcome, the output should rise sharply — if the existing oil policy holds good. ★ ★ ★

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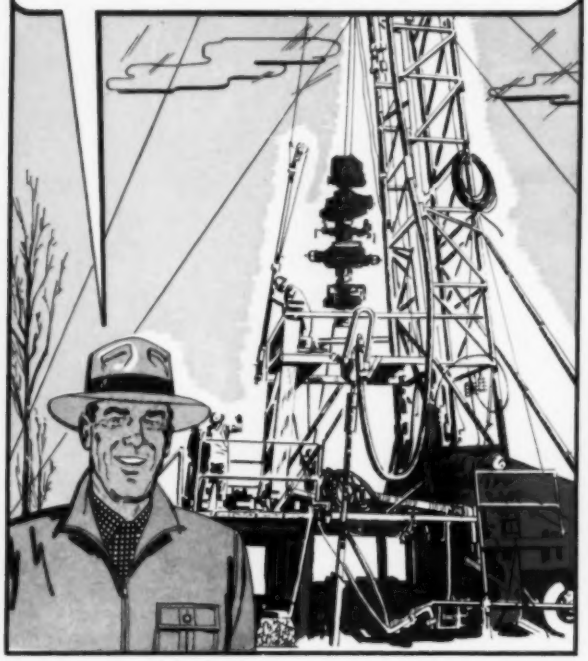

WE'VE GOT A 6,000-FOOT DUAL-PRODUCER HERE THAT IS EITHER LEAKING AROUND THE PACKER OR HAS A HOLE IN THE TUBING. AT LEAST SOMETHING WENT WRONG BECAUSE WE HAD A SUDDEN PRESSURE DROP ON THE LOWER ZONE AND AN INCREASE IN PRESSURE ON THE UPPER ZONE. IN EITHER EVENT, WE'RE GOING TO HAVE TO PULL THE TUBING.

OTIS' CHARGES TO ROUND-TRIP THE TUBING UNDER PRESSURE WILL FIGURE ABOUT $2,800.00—EXCLUDING RIG COSTS.

6...12 hour days
or 72 hours as follows:
The first 40 hours...$1600.00
32 hours at 30.00 an hour..960.00
Mileage charges are
80 miles at 75¢ per mile...60.00
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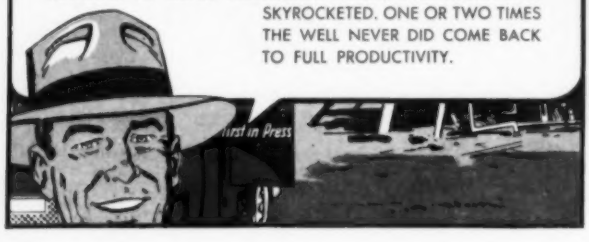
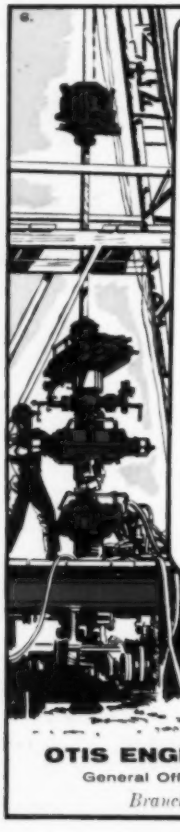
tubing and remove plug...170.00
$2,790.00

OUR DISTRICT PRODUCTION SUPERINTENDENT'S OFFICE ESTIMATES IT WOULD COST AROUND $4,400.00 TO KILL THIS WELL WITH MUD—EXCLUSIVE OF RIG COSTS. THESE FIGURES ARE BASED UPON COMPLETING THE JOB WITHOUT RUNNING INTO TROUBLE, OF COURSE.

Oil base muds.....$2200.00
Pump truck to kill well..580.00
Steel mud pits.....100.00
Reserve pits.....100.00
Swabbing.....200.00
Extra mixing and pump
time to handle
oil base muds.....1200.00
$4,380.00

BESIDES THE INITIAL CASH SAVINGS WE'LL MAKE BY USING OTIS TUBING SERVICE, WE'RE ELIMINATING THE POSSIBILITY OF FOULING UP THE PRODUCING FORMATIONS WITH MUD. ON A FEW OCCASIONS, WE KILLED A WELL BECAUSE WE THOUGHT IT WOULD REDUCE OUR WORKOVER EXPENSES—BUT BY THE TIME WE GOT THROUGH CLEANING UP THE FORMATIONS TO BRING PRODUCTION BACK, OUR COSTS HAD SKYROCKETED. ONE OR TWO TIMES THE WELL NEVER DID COME BACK TO FULL PRODUCTIVITY.

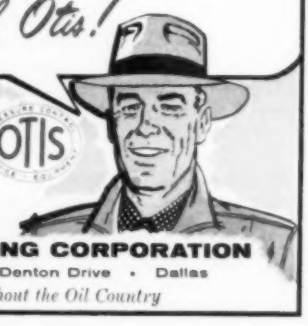




OTIS FURNISHES ALL THE SPECIAL TOOLS, EQUIPMENT, AND TRAINED PERSONNEL TO DO THE JOB. ONCE THEY RIG UP THEIR CONTROL HEADS, SNUBBERS, AND LUBRICATOR, THEY SET A PLUG BELOW THE PACKER OR IN THE BOTTOM JOINT OF THE TUBING. WHEN THIS IS COMPLETED THEY START COMING OUT OF THE HOLE WITH THE PIPE. THEIR CREWS ARE FAST AND EFFICIENT, AND PULLING TUBING UNDER PRESSURE IS NO STRAIN THE WAY OTIS DOES IT. SO, NATURALLY WE USE OTIS TUBING SERVICE ALL THE TIME. WE'VE FOUND WE CAN SAVE BOTH TIME AND MONEY THE OTIS WAY. IF YOU HAVEN'T BEEN USING OTIS REGULARLY I SUGGEST YOU CONTACT THEIR NEAREST OFFICE TODAY. REMEMBER—

don't kill your well....

Call Otis!



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When so much time and money are invested for one purpose—to locate oil—we can't afford to guess about the productivity of a few feet of rock. We know from experience that the success of the entire venture depends upon complete information on the possible pay zone.

And there's no need for guesswork when coring delivers lasting physical evidence of the production potential of the reservoir. Information on storage capacity, permeability, formation fluids, fractures, fluid contacts, rock types and characteristics is readily available to the analyst, enabling him to forecast more accurately the primary and secondary performance of the well.

To assure highest core recovery, Christensen core barrels incorporate a stabilized, ball bearing suspended inner barrel which receives and protects the core from washing, blocking or friction grinding. Working with the smooth cutting diamond core bits, these barrels deliver top quality cores in all types of formations.

Whether you are planning to core hard, friable or soft, unconsolidated formations, there is no need for guesswork. Let Christensen show you how to get more from your investment by obtaining complete, lasting evidence of the formation below your rig. Christensen Diamond coring equipment gives you the greatest amount of core recovery at "Less Cost Per Foot."

A complete line of conventional, rubber sleeve and wireline core barrels is available. For information on these and a complete line of diamond coring bits — Write or call Christensen Diamond Products Co.

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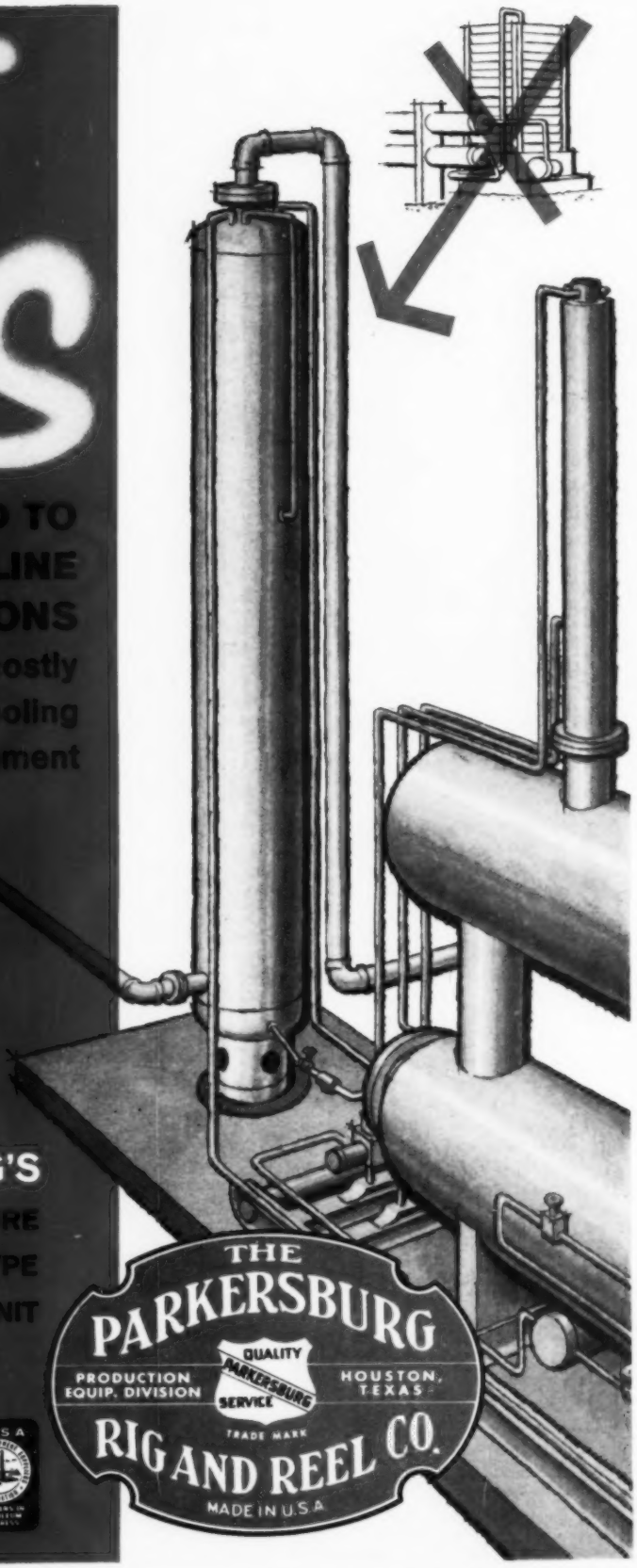

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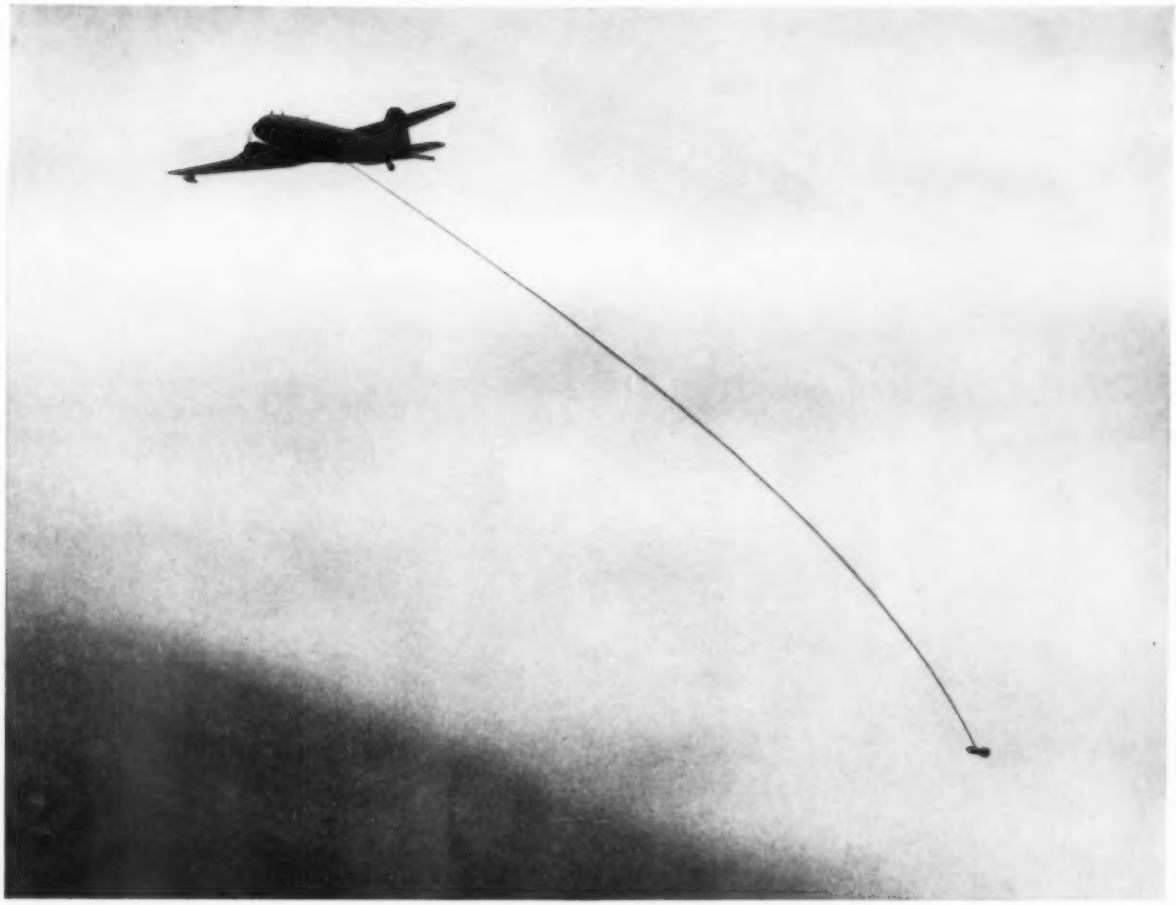

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With Radan, AERO can make magnetic surveys before or during the mapping program, avoiding the usual delay for completion of aerial photography. Reconnaissance over unexplored country is as dependable and technically excellent as lines flown in well-mapped areas.

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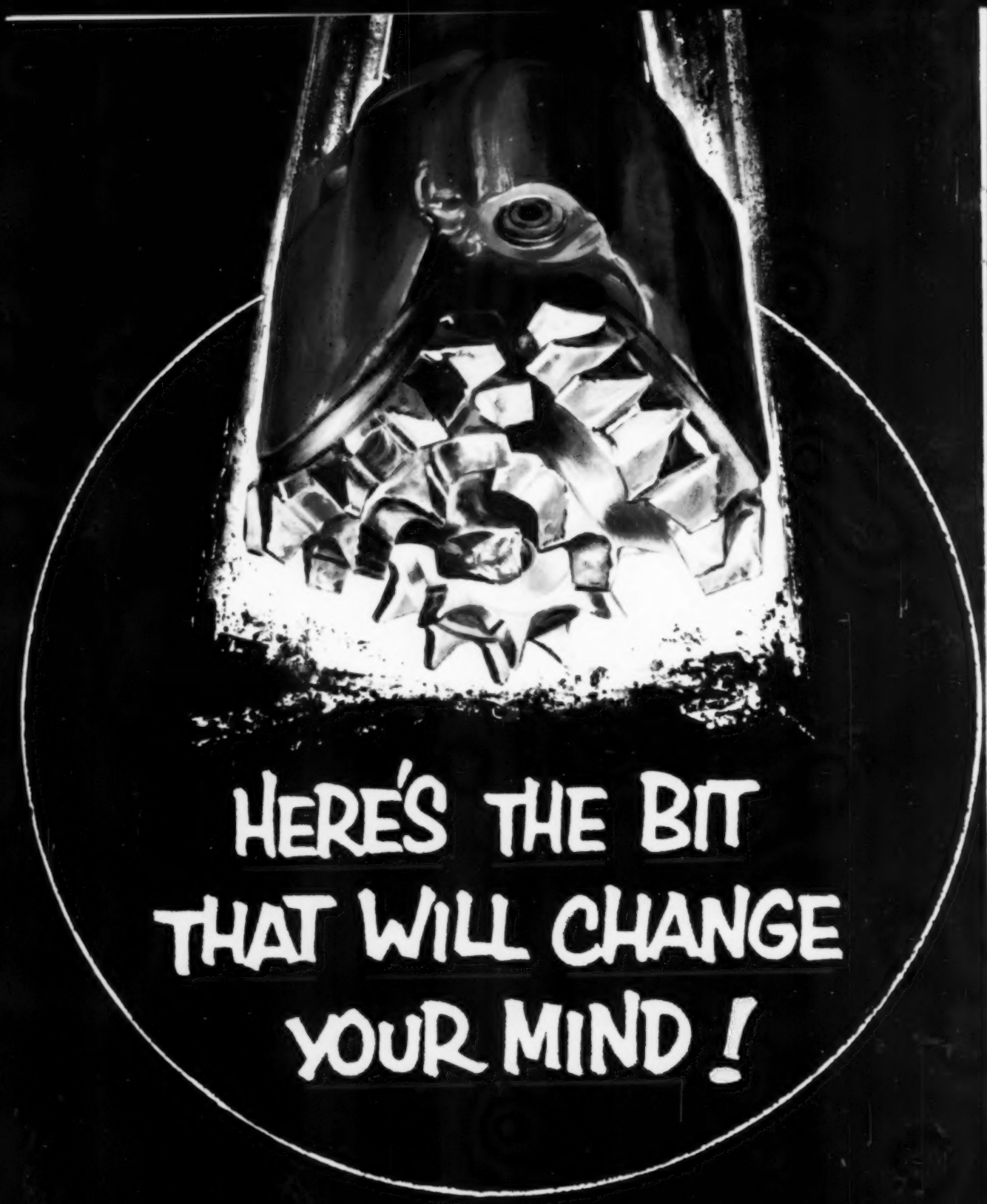
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How much is EFFICIENT mud de-sanding worth to you?

Comparative tests have shown actual savings of nearly 6000 Dollars per well when Dorrco D-Sanders were used in drilling South Louisiana wells. With results like that, the cost of the D-Sander was paid off fast and overall well costs were substantially reduced.

Many users of other designs, some shop-fabricated and some purchased, have found that mere treatment of mud with a cyclone action is not sufficient to obtain the results reported above.

What was the difference?

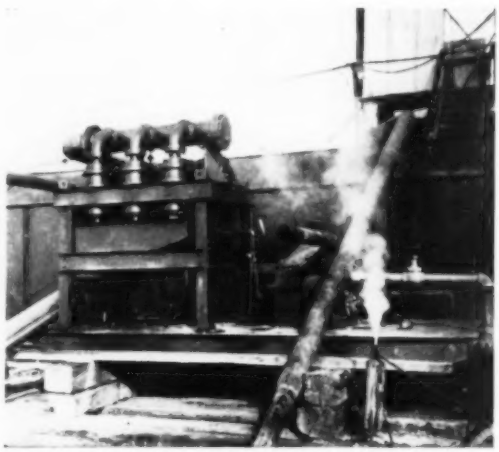
The main difference was the de-sander actually used. The comparative tests mentioned here were conducted using a high-capacity Dorrco D-Sander that had been engineered by Salt Water Control, Incorporated, of Fort Worth.

This unit removes virtually all the sand and much of the finer drilled solids from 600 to 800 gallons of mud per minute. By actual measurement, a Dorrco D-Sander has removed over 1500 barrels of sand and clay from the mud while drilling a single well to 9200 feet, thereby keeping sand content less than one-half per cent and solids low.

An important advantage of the Dorrco cyclone is its "balanced" design. Since there is no underflow unless undesired solids are present in the mud, waste of water, oil, and expensive drilling chemicals are held to a minimum. It is practical to operate the Dorrco D-Sander continuously and avoid expensive intermittent increases in sand content.

D-Sanders are engineered for long trouble-free service. Some units have been in service for over two years without major repairs. All parts have been engineered to withstand abrasion from high velocity sand. The entire unit is ruggedly built to take repeated moves without damage.

Whatever benefits you want from de-sanding (faster drilling, more footage per bit, less wear on mud pump parts, easier running of casing) you will get them in full measure with a Dorrco D-Sander. Be safe instead of sorry! Be sure to ask your SWACO representative for full information before you buy *any* de-sander. You will be glad you did.



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TRETOLITE SERVICE
report

TRETOLITE FIRST

WITH FOUR MONEY-SAVING AIDS TO PRODUCERS

The following four production aids have been field-proved by billions of barrels of treated crude—and have saved producers literally billions of dollars over the years.

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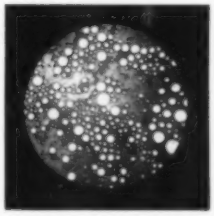
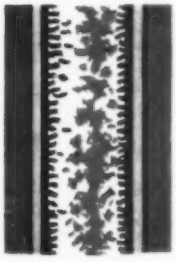
Demulsifiers



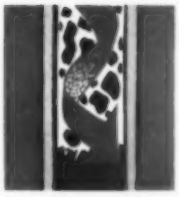
The first chemical demulsifier used in the petroleum industry for the recovery of emulsified crude oil was invented by William S. Barnickel, founder of the Tretolite Company. Since then, TRET-O-LITE demulsifiers have rendered useful millions of barrels of crude oil that might otherwise have been lost. Today, many TRET-O-LITE formulas are available not only for the recovery of emulsified production, but also for salt removal from crude oil, and useful oil salvage from tank bottoms and slop oil systems.

2. KONTOL*
Organic Corrosion Inhibitors



Tretolite Company research and field engineering developed the first organic corrosion inhibitors specifically for petroleum equipment and pioneered their first application. Today, KONTOL Corrosion Inhibitors are used in the production (as well as refinery and pipeline) departments of leading oil companies everywhere.

3. SOLVO*
Paraffin Removers



Paraffin removers which contain neither carbon bisulfide nor organic chlorinated solvents were first introduced by Tretolite. The harmful effects of chlorides in crude oils on certain refining catalysts have made clear the need for such chloride-free paraffin removers.

4. FLUDEX*
Multi-purpose Water Flood Additives

Another Tretolite "first", this series of products combines the features of organic corrosion inhibitors, bactericides, scale preventives and wetting agents. Widely used in water-flood operations, FLUDEX additives increase injectivity, and at the same time, mitigate problems arising from corrosion, bacteria and scale. They are also being effectively applied for backwashing water-flood filters, water clarification, and stimulating production in stripper wells.

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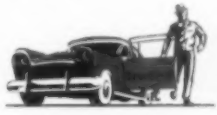
For further information on how these and other money-saving Tretolite aids can fit into *your* operation, *ask the Man in the Red Car*—your own Tretolite Field Service Engineer.



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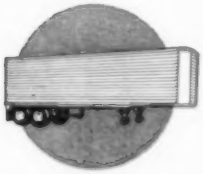

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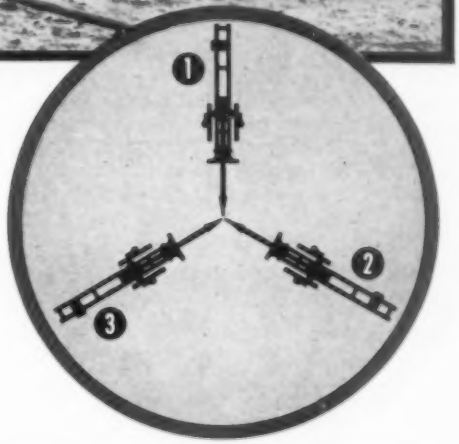

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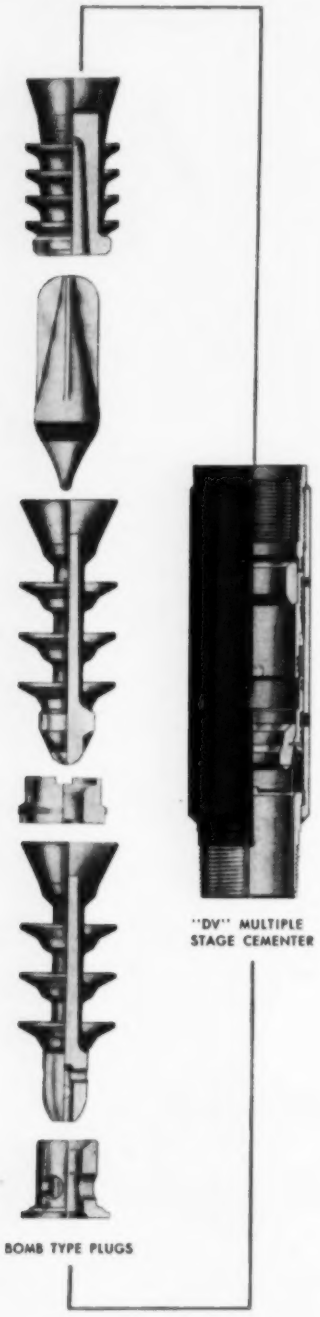

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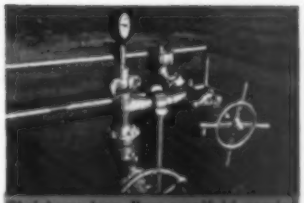

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COST REDUCTION:

Homework for the Domestic Producer

L. F. McCollum, *President*
Continental Oil Company
Houston, Texas

"The domestic petroleum industry today is being squeezed between two powerful and opposing sets of economic forces: Steadily rising costs and downward pressures on prices . . . It's high time we moved to meet the situation"

COST REDUCTION in the producing end of the domestic petroleum industry is not a popular topic. Cost reduction is a tough chore, and tough chores are rarely popular. This topic, however, is a vitally important one. The domestic oil producer today is beset on all sides by economic pressures which are tending to narrow his profit margin and to reduce his return on investment. The only solution to these difficulties lies in aggressive, imaginative cost reduction.

Position of the Domestic Producer

The improvement in general business which started several months ago, and which is currently well underway, has been accompanied by growing fear of a possible resumption of inflationary trends in our economy. This fear stems from the realization that in many industries increases in wages have outstripped increases in productivity and may well continue to do so. If this trend continues, a substantial portion of the swollen costs will inevitably have to be passed along to consumers in the form of higher prices.

This process is vicious for our economy as a whole because it results in continuous increases in prices, higher costs of living, and erosion of savings. But its impact is felt most keenly in industries which for varying reasons are unable to recoup, even in part, rising labor and material costs through higher prices for their products. This is the situation in which the domestic producing industry finds itself today.

One set of economic forces is driving finding and development costs upward, and another set of forces is holding crude and product prices down. These forces act as the opposing jaws of a vise to squeeze profits in the domestic petroleum industry. Let us consider each of the jaws of this vise and then direct our attention to the means by which we may be able to relieve the painful pressure.

Presented to the Production Division of the American Petroleum Institute, annual meeting, Chicago, Illinois, November 11, 1958.

Rising Costs

The domestic petroleum industry, in common with other industries in this country, has experienced rising costs for labor, materials, and services.

In addition, the domestic petroleum industry has suffered cost increases which are peculiar to it alone. Oil and gas reserves are becoming increasingly difficult to find. The depth and cost of exploratory wells is steadily rising, and the number of large fields found each year is steadily declining. The rising cost of domestic oil is easily demonstrated. For example, the Chase Manhattan Bank estimates that the group of major companies covered by its studies increased expenditures on oil finding and developing from $1.22 per bbl of oil produced in 1948 to $1.91 per bbl produced in 1957. This is an overall increase of 57 percent or more than 5 percent per annum for the 10-year period.

In our own company during the past year, we have made some fairly elaborate studies of long-term trends in domestic oil finding and developing costs. In fact, we have prepared some 18 different estimates to allow for the many different theories as to how such costs should be computed. These trend lines all fall within a reasonably narrow range, and the upward movement is strikingly uniform.

Restraints on Price Advances

Let us look now at the other jaw of the vise. If things worked out as nicely in practice as they do in theory, crude oil prices should have kept pace with rising costs. In a highly competitive situation, however, costs and prices do not always move hand in hand. And they certainly have not done so in the case of domestic crude oil. Average crude oil prices in the United States today, according to the Bureau of Labor Statistics, are only 21 percent above the 1948 level, as compared with an increase of at least 57 percent in finding and development costs.

Moreover, the prospects for general increases in domestic crude oil prices in the near future do not appear particularly bright, no matter how substantial future increases in costs may be. The factors which have limited, and will continue to limit, an increase in the price of domestic crude oil are (1) intense competition from foreign oil which can be delivered to the United States at lower cost than domestic crude, (2) the existence of ample domestic crude oil productive capacity, and (3) increasing competition faced by distillate and residual fuel oils from alternate types of energy. Let us consider each of these three factors:

1. **Foreign crude oil:** It is sometimes difficult to grasp the magnitude and significance of the huge crude oil discoveries made in recent years in the Middle East, North Africa, and Latin America. Studies by our economics

group indicate that since about 1952 the ratio of reserves to production in the Free World has jumped abruptly from a long-term historical level of approximately 20 to 1 to something well in excess of 40 to 1. We also know that some of the great new Middle Eastern fields have been only partially defined and that further drilling is likely to prove up quantities of oil far beyond present estimates. The development of North Africa is just beginning.

Clearly, the Free World today has a far greater availability of crude oil in relation to demand than at any time in the past 40 years or more. As long as this abundance of supply exists, prices in the Free World markets will be under constant downward pressure. This pressure will be felt particularly keenly in the United States, because foreign oil has significant cost advantages over domestic crude. It is generally recognized, for example, that Middle Eastern crudes can now be delivered for refining on the East Coast at least 50 cents per bbl below the prices for comparable West Texas crudes.

2. **Domestic productive capacity:** We cannot, of course, attribute all of the present abundance in oil supply to foreign discoveries. If we want to appraise our problem squarely and impartially, consideration must also be given to the recent, rapid expansion in domestic productive capacity. Let me promptly make it clear that I am thankful for every barrel of oil discovered on this continent. In the long-run, we shall need all we can find—and a great deal more besides. Our exuberance in development drilling, however, has created productive capacity which is temporarily well above our current needs.

Since World War II, five special committees have been appointed at various times (one by the American Petroleum Institute and four by the National Petroleum Council) to prepare studies of our domestic productive capacity. The latest NPC report estimated productive capacity of crude oil and natural gas liquids as of January 1, 1957, to be 10.7 million bbl daily. Total production in January 1957, according to this report, was at the rate of 8.3 million bbl daily, or at 77 percent of capacity.

One year later, a committee of the IPAA reported that in January 1958, the domestic industry was operating at 74 percent of capacity. The IPAA committee's estimate was prepared on a somewhat different basis than that of the NPC. Both estimates indicate, however, that in 1957 and 1958 the domestic producing industry operated at well below 80 percent of capacity.

The disparity in the growth of domestic consumption and domestic

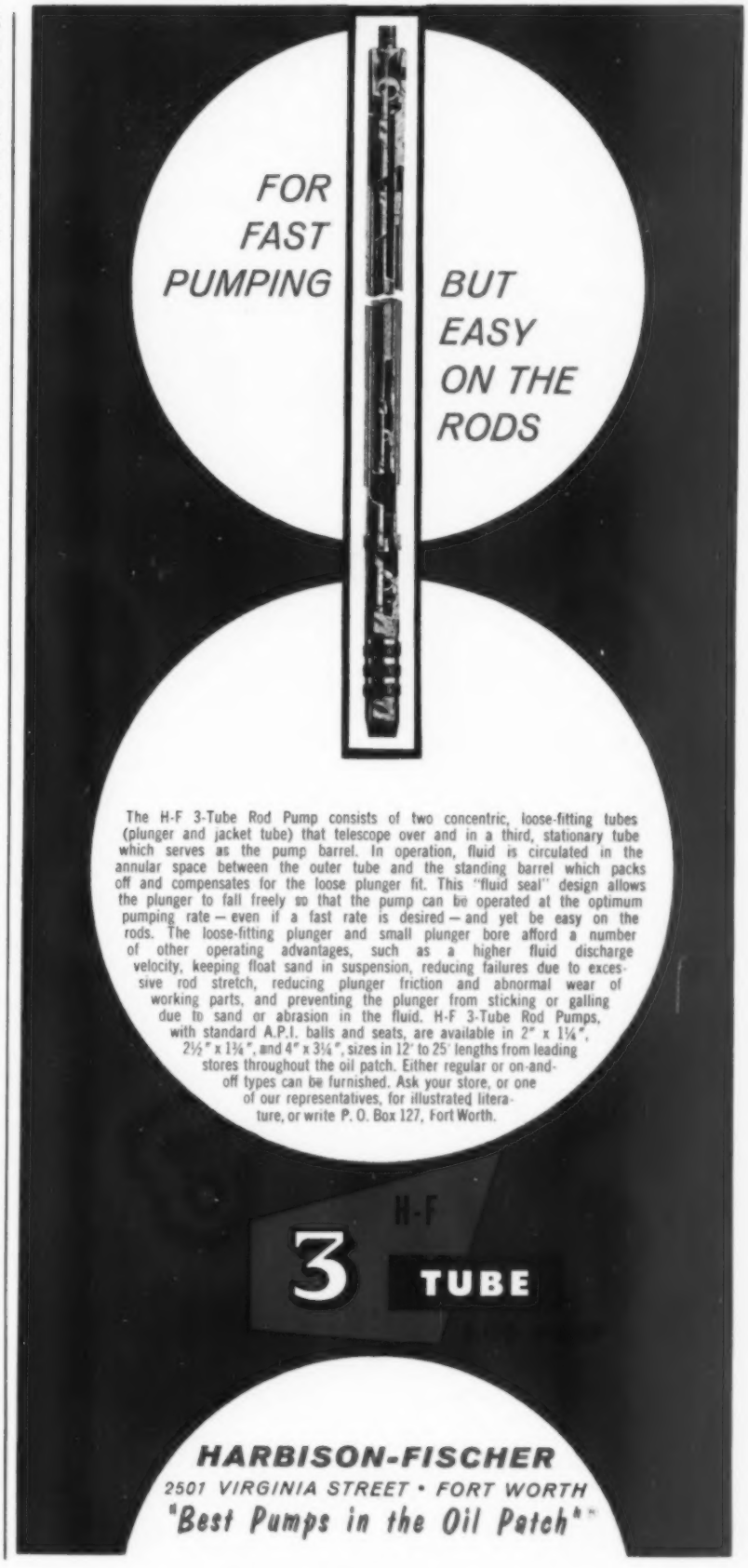
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TABLE 1. Crude Oil Productive Capacity and Crude Oil Consumption.
(in thousands of barrels per day)

	1956	1950	Increase Total	Increase Yearly Average
Productive capacity, end of year	9867	6727	3140	523
Domestic production	7151	5407	1744	290
Imports	934	487	447	75
Total crude consumption	8085	5894	2191	365
Excess, capacity over domestic production	2716	1320	1396	233
Excess, capacity over total crude consumption	1782	833	949	158

productive capacity is revealed in the above figures (see Table 1): During the six years from 1950 through 1956, domestic requirements of crude oil increased about 365,000 bbl daily each year. Approximately 75,000 bbl of this average annual gain was met by increases in imports of foreign oil. The net gain in consumption of domestic crude oil was thus only 290,000 bbl daily each year. Meanwhile, according to the NPC studies, domestic productive capacity increased 523,000 bbl daily each year.

Two conclusions may be drawn from these figures: First, the difference between the average annual increase in consumption of domestic crude oil and in domestic productive capacity, amounting to 233,000 bbl a day each year, is one measure of the extent to which our ability to produce oil has outstripped our current needs. Second, it is apparent that *even if imports of foreign oil had not increased at all,* the growth in our productive capacity during this period would still have exceeded the growth in our requirements by 158,000 bbl daily each year.

3. **Competition from other fuels:** A third circumstance tending indirectly to restrain crude oil price advances is the increasing competition certain petroleum end products are facing from other fuels. This is particularly true in the case of distillates and residual fuel oil. Natural gas is making large inroads in the domestic heating oil market. Since 1950, residential uses of natural gas have grown about 50 percent faster than distillate sales.

In the industrial and commercial markets, coal is offering increasing competition to both distillate and residual fuel oils. Competition in these markets is based almost entirely on price, except in situations where distillate has an advantage because of its greater convenience. Under the pressure of necessity, the coal industry in recent years has been improving its technology. New mechanized extraction methods, underground gasification, and pipeline transportation are now helping to make coal more competitive with oil.

Interference with Gas Prices

This brief outline of the problems faced today by the domestic producer would not be complete without reference to the natural gas situation. Oil and natural gas are necessarily found and produced as joint products, and the combined revenue from oil and gas sales must be sufficient to cover the total costs of exploration and production and yield the producer an adequate return on his investment.

As we have seen, crude oil prices are experiencing downward pressures because of abundant supplies in the Free World markets. Quite a different situation exists in the case of natural gas. Here the markets are expanding rapidly and are absorbing a steadily growing volume of output. However, gas prices are being held below their natural economic level by the Federal Power Commission. The domestic producer is thus deprived of revenue from natural gas sales which would properly be his in a free competitive market and which would be of great assistance today in helping to offset the rising overall costs of exploration and production.

In my judgment, it is vitally important to find ways and means of freeing the domestic gas producing industry of burdensome Federal controls.

NEEDS AND OPPORTUNITIES FOR COST REDUCTION

Thus far I have had a doleful tale to tell. As domestic producers, we face a difficult situation. But we need not be dismayed or discouraged by the outlook for the years ahead. As you may know, this industry has faced tough problems many times before and has usually come through with flying colors. I am confident that we can do so on this occasion.

In my opinion, our only line of attack against the many economic pressures bearing upon us is an aggressive, imaginative program of cost reduction.

It is imperative that we evolve methods of discovering oil more economically and developing and producing it at lower costs. Cost reductions are essential if profit margins on domestic operations are to be maintained at levels which will enable us to generate and attract the large amounts of new investment capital necessary for the maintenance of a strong domestic oil industry. We must also remember that the cash generated from domestic operations often furnishes the initial capital for foreign ventures by United States companies until such ventures, if successful at all, become self-supporting.

Few would question the desirability of cost reduction or the need to give it first priority at the present time. The $64 question is, of course, how do we go about it? Let us consider the composition of our costs and some of the fruitful fields into which our efforts should be directed.

There is no precise information available on the composition of the domestic petroleum industry's costs. Based largely on my own experience however, I believe that the cost, including both capital and expense items, of finding, developing, and lifting oil in the United States in recent years has been distributed approximately as:

	Percent of Total
Finding costs	35
Development costs	45
Lifting costs	20
	100

There are a number of things we can do to bring about reductions in each of these main categories of cost.

Improved Development Drilling Programs

You will note from the figures that 65 percent of our costs are for developing and lifting. These costs thus form a very important part of the total, and here is where some significant cost savings are clearly attainable.

Important reductions in both developing and lifting costs could be made through the further application of sound engineering and economic principles to our development drilling programs. For the past several years, we have been drilling more development wells than necessary to recover oil efficiently and to meet current requirements. This practice has contributed substantially to the upward movement in developing and lifting costs per barrel which I mentioned earlier.

Looking back at the record of the producing segment of the industry during the postwar era, it is apparent that several major technological developments have occurred in the producing side of the business. Our petroleum engineers and research people have made great progress in production knowledge and techniques. Their findings include, among other things, scientific data on proper spacing of wells, efficient methods of producing oil reservoirs, and various ways of supplementing natural reservoir energies.

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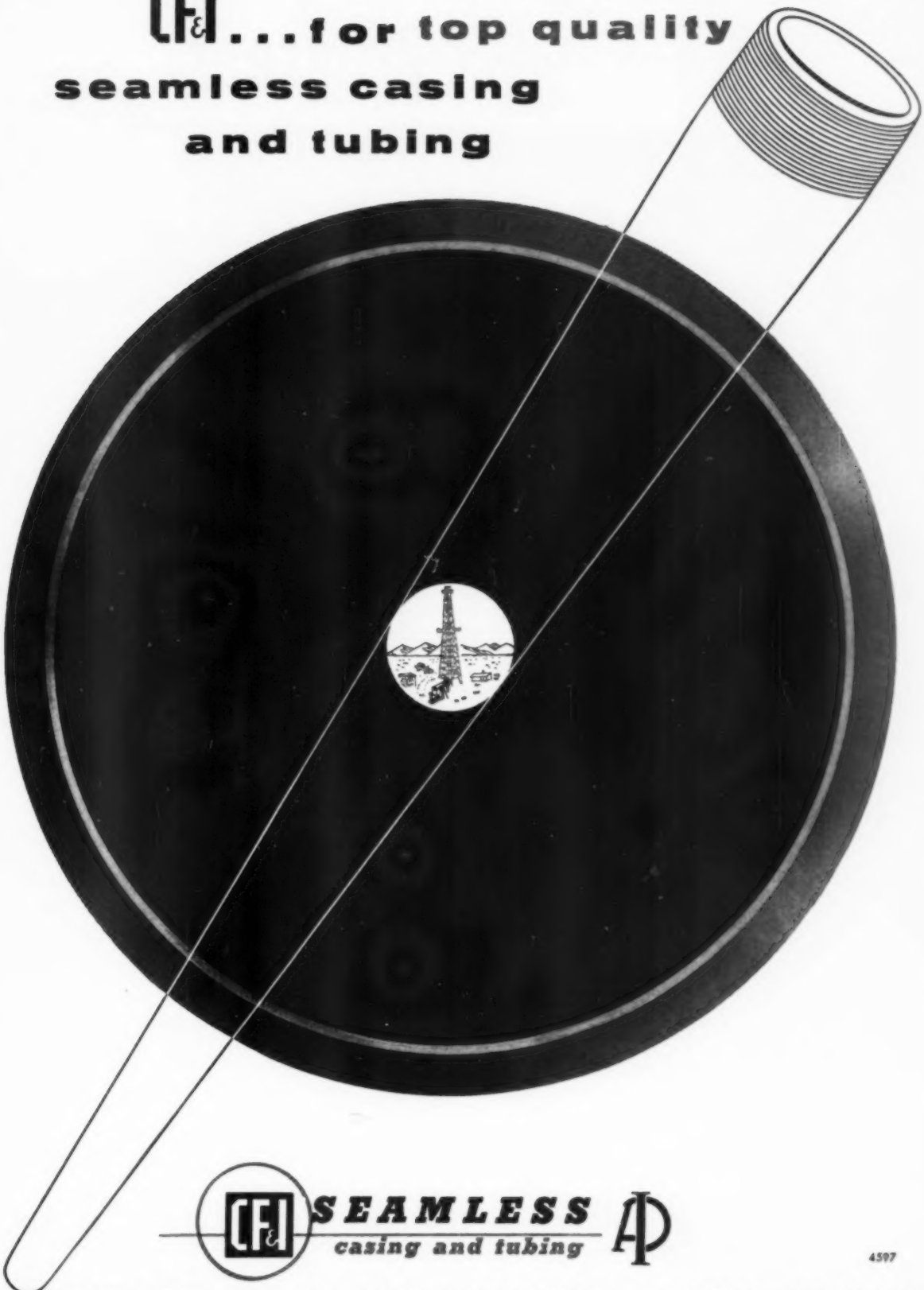

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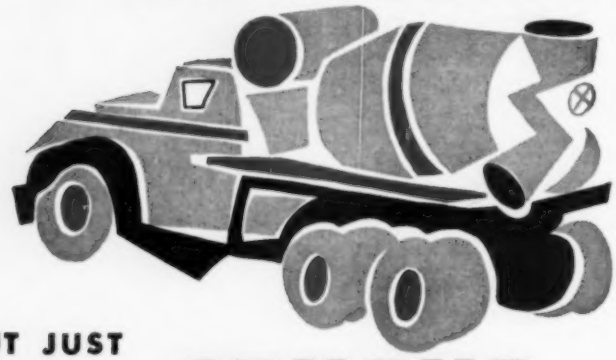

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All these findings, without exception, could have served to reduce the number of wells required to recover oil from a given reservoir. But due to the intensely competitive nature of the petroleum industry and various other circumstances, these findings have been used in many instances, not to reduce costs, but simply to increase productive capacity.

As a result of undue emphasis on the drilling of development wells, we have increased our productive capacity far ahead of the increase in our underground reserves. The latest National Petroleum Council committee on productive capacity reported that "for the United States as a whole, productive capacity has increased more rapidly than proved reserves, with the result that the ratio of crude oil reserves to annualized productive capacity declined from 10.3 on January 1, 1953 to 8.5 on January 1, 1957." Since then there probably has been a further deterioration in the ratio of crude oil reserves to productive capacity.

The domestic industry can now produce its reserves at a much faster rate than ever before. But so long as the increased productive capacity has to be shut in for lack of markets, the investment made to create it is completely non-productive of earnings. Based on the experience of the last few years, our scientific know-how deserves a grade A mark. But how would you rate our economic common sense?

OUR COURSE FOR THE FUTURE IS CLEAR

We must seek means of curtailing the drilling of unnecessary development wells. This will not be easy. Excessive development drilling is due primarily to two factors: (a) Oil producers often drill more wells than are necessary for the efficient draining of a reservoir in order to protect their underground rights or in their zest to obtain additional output, and (b) state proration laws, which generally limit production on a per-well basis, lead to excessive development wells in an attempt to increase production.

The first problem—that of the interests of land owners and operators—is by far the most difficult. A proper solution involves such things as agreement of all interested parties on a unitization plan early in the life of a field. Progress in this area will require a concerted effort toward educating oil producers, land owners, and drilling contractors. The second problem—the appropriate basis for proration—may be more easily solved. Conservation bodies already recognize the need for prorating production on a "field reserves" rather than a "per well" basis. In addition, state laws and regulations could be formulated to encourage new

production techniques which would lead to cost reductions.

Improved Exploratory Techniques

A second major means by which we may achieve important cost reductions is through improvements in our exploratory techniques. The surest way to reduce oil finding costs is, of course, not to drill any dry holes—at least that is my constant admonition to my own exploration people! Although this particular approach is received somewhat coolly by my explorers, there are nevertheless some ways finding costs can be brought under closer control.

For example, recent experience indicates that there are opportunities for cost reduction through such devices as improved subsurface analysis and correlation; improved seismic recordings using magnetic tape; and improved core drilling equipment, like the fast portable offshore rig now being used on the West Coast.

Another great opportunity for cost reduction lies in the development of techniques for the location of oil accumulations in stratigraphic traps. Only a small portion of the cubic area which is potentially oil bearing in this country has yet been tested by drilling. Much oil remains to be discovered in stratigraphic traps which can seldom be located today except by costly drilling operations. A scientific "breakthrough" which would give us a means of locating these traps economically would significantly reduce our future finding costs.

Improved Recovery Techniques

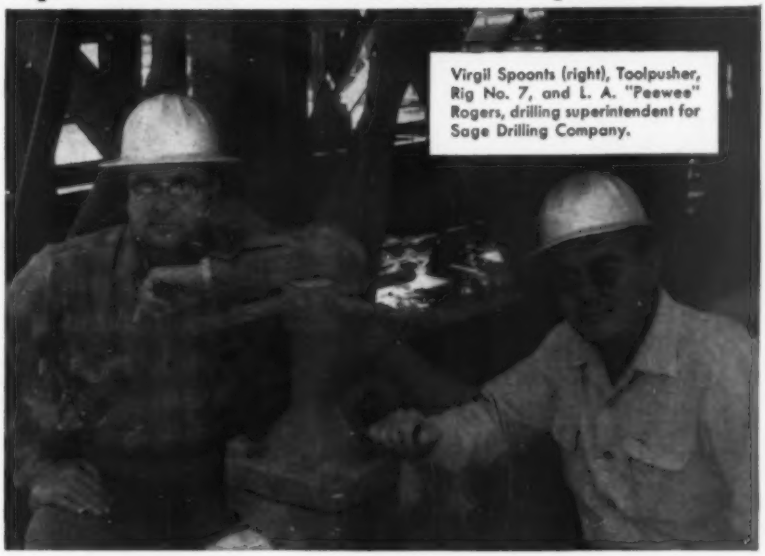
A third, and highly important, means of reducing unit costs is through improved recovery techniques. At the present time, we are recovering only about one third of the oil in underground deposits. In recent years, significant progress has been made in the handling of well-fracturing, water floods, gas injection, miscible floods, in situ combustion, and various other methods of increasing recovery.

The possibilities in this area have by no means been exhausted, and they offer exciting opportunities for further cost reduction. Consider, for example, what would happen to our finding and developing costs per barrel if we could discover a means of doubling the average recovery from oil reserves! And even this would not bring us to the end of the road, because we would still be leaving one third of our oil in the ground.

Increased Research

Finally, I would like to lay heavy stress on the most important cost saving device of all; namely, increased research on all phases of our oil finding, developing, and lifting activities. Im-

Tips on Mud Valves for Toolpushers...



Virgil Spoonts (right), Toolpusher, Rig No. 7, and L. A. "Peewee" Rogers, drilling superintendent for Sage Drilling Company.

Our Mudwonder Valves just *don't* sand up!

by Virgil Spoonts, Toolpusher, Rig #7
Sage Drilling Company, Blanding, Utah

"I'VE used a lot of different mud valves in 10 years of toolpushing. Used to be, I'd have to baby them along . . . operate the standpipe valve every day or so to keep 'em flushed out. If I didn't, they'd sand up so bad I'd need a 36-inch wrench to close them.

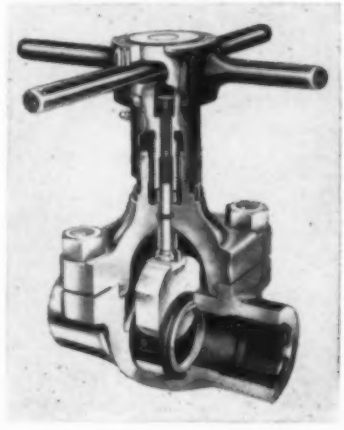
"But not with Mudwonders. I've never had one jam up with sand in the seat. As soon as I bring the gate down close, the flow sluices all sand out of the way. I close 'em hand-tight and they hold. Never need a wrench.

"We rigged up new with Mudwonders on Number Seven. 17 two-inchers and 4 of the four-inch size. Since we started drilling, in August, 1957, we've had to repair only one of them. It was used on jet and hadn't been properly closed. But it's real easy to put in a new insert—or even a gate—without disturbing any connections.

"Lack of downtime is mighty important to us. We've had *no* lost time due to Mudwonders, except the ten minutes it took to repair the one I mentioned. Parts are no problem, either. We just keep a couple of seat inserts and an extra gate on hand for each size—how's *that* for inventory control?"

Mudwonder valves are built in 2", 3" and 4" sizes; with screw or flange ends; for 2000 psi WP (4000 psi test) and 3000 psi WP (6000 psi test) service. See your favorite oil field supply store, or write Edward Valves, Inc., East Chicago, Indiana, subsidiary of Rockwell Manufacturing Company.

Mudwonder cut-away view shows the one-piece seat insert, with Buna-N molded integrally over steel wear rings; chromed gate with "T" slot connection; separated stainless stem and double thread construction.



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HOW OLD HOLE WAS DEEPENED OVER 1000′ THROUGH 5½″ CASING

with V-Door bits PATENT APPLIED FOR

HYCALOG

CONTINUING RESEARCH FOR LOWER COST DRILLING

Drilling through small diameter casing in a recent Mississippi deepening program demonstrated further the economy of using HYCALOG V-DOOR diamond bits.

In the run from the old total depth of 10,109′ to the new completion depth of 11,200′ only three 4 11/16″ bits were required. The first, going in the hole on Nov. 23 made 385 feet through shale in 93 hours, averaging 4.4 feet per hour. The second, gnawing its way through 513 feet of shale, anhydrite and sand, averaged 3.6 feet per hour. The third completed the well on Dec. 7 after making 193 feet at an average of 4.8 feet per hour in hard sand and shale in the Rodessa formation.

The three diamond bits replaced many times that number of conventional bits, *yet cost no more* . . . the number of trips was reduced proportionately, . . . rate of penetration was exceptionally good . . . and, in spite of the small diameter at that depth, it was a clean operation without any down time.

This is just one of a number of such records set by HYCALOG V-DOOR *bits. Why not let* V-DOORS *set a record on your next drilling program?*

Hycalog, Inc.

505 AERO DRIVE
SHREVEPORT, LOUISIANA

BRANCH OFFICES IN PRINCIPAL OIL PRODUCING AREAS

DIAMOND CORING • DIAMOND BITS • WELL LOGGING • CORE ANALYSIS

B-108

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agine for a moment what would happen if we could direct the same kind of intensive, creative scientific effort into the oil industry that went into the creation of the hydrogen bomb, atomic submarines, earth satellites, and the recent moon rockets! If the formidable technological problems involved in these developments can be solved, is it too much to expect that we can find surer ways of locating oil, cheaper means of drilling holes, and better techniques to increase oil recovery?

We have always prided ourselves on being a progressive industry. How then do we account for the fact that our research expenditures are low relative to those of many other major industries in the United States? Total money spent in all phases of exploration and production research is estimated at about $40 million per annum, which is less than 1 percent of the entire industry's estimated capital expenditures in 1957. Clearly, we could afford to spend many times this amount to make even small improvements in such things as techniques for locating stratigraphic traps or increasing secondary recovery or developing cheaper methods of drilling offshore.

Conclusion

The domestic petroleum industry today is being squeezed between two powerful and opposing sets of economic forces: Steadily rising costs and downward pressures on prices arising from the temporary abundance of crude oil supply in the Free World markets. These opposing forces are making it increasingly difficult to earn a satisfactory return on new investments in domestic oil finding and developing activities.

It is high time we moved aggressively and courageously to meet the situation. Our first line of attack lies in an imaginative, vigorous program of cost reduction in all phases of our operations. Among other things, we must find means of curtailing unnecessary development drilling, improving exploratory techniques, increasing oil recovery, and expanding our aggregate expenditures on scientific research.

This has been a great industry, an industry of high spirit, adventure, and opportunity, and I would not want to see it change. I am fully convinced, however, that if we do not find the means of reducing the cost of domestic oil, this industry may seek increasingly various kinds of government assistance and will forever regret the stifling blanket of federal controls which will inevitably result.

The challenge to reduce the cost of domestic oil is probably as great a test as we've ever faced. The *will* and the means to meet the challenge must be found—and find it we will! ★ ★ ★

GAS ENGINES DO IT AGAIN!

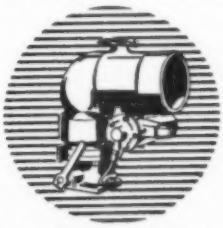
Worlds' Deepest Well

TRIPLE Le Roi V12 L-4000'S with ENSIGN CARBURETION

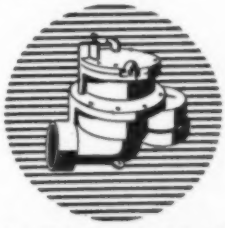
Monstrous power of these triple LeRoi gas engines pushed the Phillips well 1-EE University, Pecos County, Texas, past the 24,000 foot mark, deepest hole in the world.

THIS IS GAS ENGINE POWER. Its unfailing dependability is, of course, taken for granted because good engine designers intended it that way. Likewise, dependable and unfailing as the gas engine carburetion must be, it, too, is taken for granted because carburetor designers at Ensign intended it that way. And so it is today for nearly half a century Ensign carburetion is OEM (original equipment) on practically all leading makes of Gas and LP-Gas power units. Ensign is dependable.

INSIST ON ENSIGN—ACCEPT NOTHING LESS!



Ensign 3" Model Dg Gas Carburetor



Ensign 2" Model B Fuel Regulator

ENSIGN
CARBURETOR COMPANY
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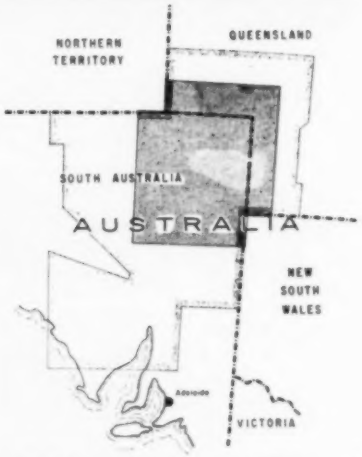
EXPLORATION ACTIVITIES

AUSTRALIA

Group Plans Queensland, South Australia Exploration

A preliminary agreement had been reached between Santos, Ltd., Frome Broken Hill Pty. Ltd., and Delhi Australian providing for a joint exploration and drilling program on approximately 110,000 square miles held under exploration licenses in the Australian states of South Australia and Queensland. The parties hope to conclude a binding agreement and secure the approval of the two South Australian state governments early this year.



Delhi Australian is a wholly-owned subsidiary of Delhi-Taylor Oil Corporation of Dallas, Texas. Santos, Ltd. is an Australian exploration company with headquarters in Adelaide, Australia. The Frome Broken Hill group is comprised of Vacuum Oil Company Pty. Ltd., BP Exploration Company Ltd., The Consolidated Zinc Corporation, Interstate Oil Ltd., and American Metal Climax Company.

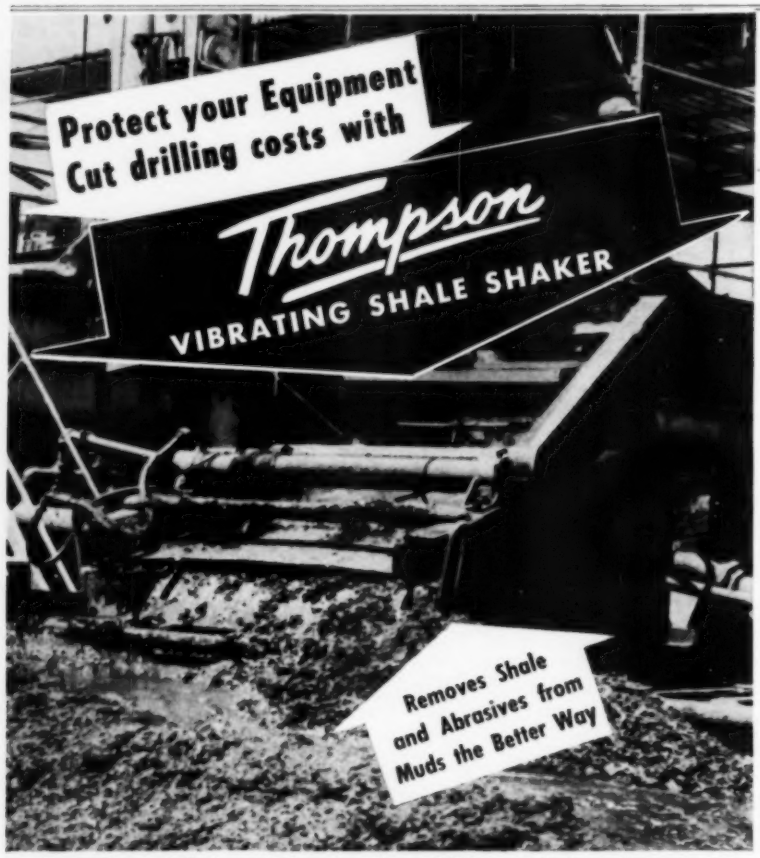
The preliminary agreement provides that Delhi and Frome group agree to expend in an initial two-year period beginning in 1959 a minimum of $2,045,000. This will provide for the drilling of three wells, one of which will be drilled to 14,000 ft. It is expected that the Australian federal government will provide subsidies toward the cost of drilling exploratory wells in the joint area which would substantially increase the total exploration expenditures during that period.

Unless the Frome group exercises their options to withdraw after the initial two-year period, additional expenditures during the next three years would bring the total amount expended to approximately $10,700,000 by the end of 1963. Any government subsidies received by the group will increase the total exploration expenditures.

Santos' contribution of acreage to the project will result in its not having to provide exploration funds. Delhi Australian will receive credits for exploration monies previously expended.

Delhi-Santos Activity Brings Offset Leasing

One-half interest in a 12,000,000-acre oil and gas concession in Australia has been acquired by Cordillera Mining Company. The concession, contiguous to that owned by Santos, Ltd. and Delhi Australian Oil Company, will be jointly owned by Cor-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VIBRATING SHALE SHAKER
Removes Shale and Abrasives from Muds the Better Way

Separation of shale and abrasives from drilling muds is an important *must* for an effective, time-conserving, money-saving drilling job. Reclamation of mud is vitally important. No matter what the mud flow or well depth may be, a THOMPSON Vibrating Shale Separator and Sample Machine stands up to meet any demand. It's field proven! *You get clean mud.* THOMPSON Separators are self-motivated... making tools last longer... with a minimum of re-tooling and restoration of mud solution.

A THOMPSON Separator is your surest bet... for shallow, medium and deep wells. The dependable Sample Machine works simultaneously with the Separator, giving a foot-by-foot mud analysis with specimens. *Write for Free Folder.*

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dillera and Australian-American Oil Pty., Ltd. The Santos-Delhi properties began their oil-gas drilling program with a 14,000-ft test, spudded in December 30.

The concession extends through the state of Queensland. The Adastra Flying Service Company of Australia has been retained to complete necessary aerial surveys.

Gravity meter studies indicate the Cordillera-Australian American properties lie in a definite trend of structure to the north and east of the Innamincka structure where the Delhi well is to be drilled, Cordillera officials say. All of the acquired properties are within the Great Artesian Basin and Cordillera will be the operating partner.

IRAQ

Basra Petroleum Yields Persian Gulf Concessions

Basra Petroleum Company, a subsidiary of Iraq Petroleum Company, has given up its concessions in Iraqi owned waters in the Persian Gulf. The announcement, made by the Iraqi government also stated that it is negotiating with all other oil concerns in the country for similar renouncements to "enable the government to exploit the oil resources in offshore areas in the country's best interests."

LOUISIANA

Trunkline, Cyprus Final Grosse Isle Pool Opener

Trunkline Gas Company of Houston has announced completion of the No. 1 Joseph Stansbury gas-condensate discovery well in Section 16, 12s, 4e, Vermilion Parish, five miles northeast of Abbeville.

The well, completed at 14,450 ft and with total depth of 15,520 ft, was a joint project of Trunkline Gas, the operator, and Cyprus Oil Company of Houston. Proposed name of the field is Grosse Isle.

Surface pressure of the discovery well is 9830 psi. On a 3/16-in. choke, it produced 4,266,000 cu ft daily and 272 bbl of condensate per day in completion tests.

Contractor for the drilling operation was the C. B. Webster Drilling Company.

CALIFORNIA

Standard-Humble Abandon Gaviota Offshore Test

The Standard-Humble offshore well, which has been drilled from a mobile barge on State Lease PRC 2199.1 near Gaviota, northwest of Santa Barbara, has been abandoned, although encouraging shows of gas and condensate have been encountered.

The well is being abandoned in a manner that will permit later re-entry.

ALASKA

Second Swanson River Well Flows at 500-Bbl Rate

The Swanson River No. 2 has been completed by Standard Oil of California, operator for a group consisting of Richfield, Ohio Oil, Union of California, and itself. The Kenai Peninsula joint venture is reported to have about the same productive capacity as the Swanson River No. 1 discovery well. The No. 2 is located about two miles north of the first successful well.

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OIL FIELD TYPE
Heavy-Duty
LONG LIFE
POWER TAKE-OFF
➡ Bearings Need Lubrication Only Once a Year
The special, large Timken main bearings in the new ROCKFORD POWER TAKE-OFF are adjusted when assembled at the factory. They require no further adjustment—and run in a reservoir of lubricating oil that needs replenishment not oftener than once a year. The clutch throw-out bearing is lubricated for life and requires no further attention. Cut down on the servicing time needed by *your* equipment by specifying this new ROCKFORD Oil Field Type POWER TAKE OFF.
SEND FOR THIS HANDY BULLETIN
Gives dimensions, capacity tables and complete specifications. Suggests typical applications.
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Small Spring Loaded
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Heavy Duty Over Center
Power Take-Offs
Speed Reducers
CLUTCHES

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What's doing in DRILLING

Rig Activity Drops Abruptly From Year-End 1958 Peak

After rising for seven straight weeks, the number of rotary rigs operating in the United States and Canada hit the 1958 peak at 2565 on December 22. But by January 5, 1959 — only two weeks later — the number had slid to 2198 active rigs.

The December 22 level of 2565 rigs at work was the high point of the usual year-end surge of drilling activity, but was 277 below the corresponding high for 1957. Like figures for previous years showed 2842 active rigs on December 16, 1957, 3132 active rigs on December 17, 1956, and 3338 on December 19, 1955 — the latter figure being an all-time high.

Magnolia to Drill 20,500-ft Wildcat

Magnolia Petroleum Company has begun drilling a wildcat well slated to 20,500 ft to test the Ellenburger. Named the No. 1 Kathleen J. Moore, the well is located in West Pecos County, 22 miles northwest of Fort Stockton and 15 miles northwest of the closest production.

The deep test is being drilled by a large Magnolia-operated rotary rig. Company executives are studying the possibilities of drilling the hole with air, rather than with gas or conventional drilling fluids.

Assam Oil Drillers Set New 8-Hour Drilling Record

A new world drilling record was set by Assam Oil Company drillers on December 19, 1958, when they drilled 2393 ft in an eight-hour shift. The feat was accomplished at Well No. 38 at Nahorkatiya, Assam, India.

According to available published records, the previous world record was 2305 ft of hole in an eight-hour shift achieved at a well in the Los Angeles Basin in California.

Twenty-seven delegates to the Petroleum Symposium sponsored by the United Nations Economic Commission for Asia and Far East in New Delhi witnessed the record-breaking tour.

Delta to Drill in Australia for Delhi

Delta Drilling Company of Tyler, Texas, has contracted to drill a 14,000-ft exploratory test in Australia's Great Artesian Basin for Delhi Australian Petroleum, Ltd., wholly-owned subsidiary of Delhi-Taylor Oil Corporation.

Delhi Australian and Santos, Ltd., jointly hold some 268,000 square miles of exploration lands in South Australia and Queensland. The well will be drilled within a 110,000 square mile area on which preliminary agreement was reached between Delhi, Santos, and a group headed by Standard Vacuum Oil Company of New York.

"C. E. Thornton" Under Tow to Persian Gulf

The mobile drilling barge "C. E. Thornton" of Reading and Bates Offshore Drilling Company is headed for the Persian Gulf, where it will be used to drill the first test ever put down in the Offshore Neutral Zone by a Japanese oil concern. The barge is expected to arrive by April 15 to begin work in concessions approved by the Sheik of Kuwait and the Saudi Arabian Government.

Working with the drilling barge will be a 260-ft tender and two 130-ft work boats. The tender and the work boats will arrive about the same time as the barge.

Company Inaugurates Blowout Preventer Testing Service

A blowout preventer testing service has been added to the list of operations of the Oil Field Rental Service Company. The testing service includes high-pressure pumps for testing up to 15,000 psi, operators trained to test all type of preventers, test plugs to fit all types of wellhead equipment, dual or single. The company has offices in Houston, Texas, and Lafayette, Louisiana, and operates across the Gulf Coast area.

Shell Completes World's Second Deepest Hole

Shell Oil Company has set 2416 ft of 4½-in. OD liner from a depth of 19,515 ft to 21,931 ft at their No. 5 Rumberger in the Elk City field, Beckham County, Oklahoma. The well, second deepest in the world, has been drilled to 24,002 ft and plugged back to 22,360 ft by Helmerich & Payne, Inc.

Casing program, in addition to the liner, included 20-in. OD set from surface to 199 ft, 13⅜-in. OD from surface to 3086 ft, 9⅝-in. OD from surface to 11,505 ft, and 7-in. OD from 11,355 ft to 20,121 ft.

Kerr-McGee Opens New York Office

A New York City office has been opened by Kerr-McGee Oil Industries, Inc., with C. J. Colby as manager. The office is located at 610 Fifth Avenue. Colby will coordinate activities of the company in the New York area. A substantial portion of his time will be devoted to foreign drilling contracts and other related phases of the company's operations.

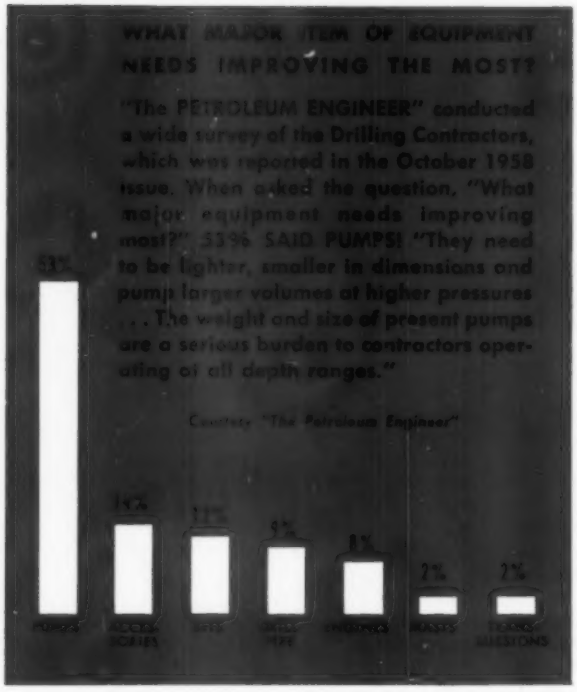
Formerly director of purchases in the company's home office, Colby has been manager of marine construction for the past several years at Kerr-McGee's Pascagoula and New Orleans offices.

Rotary Rigs Operating in Oil Fields of United States and Canada

As reported to American Association of Oilwell Drilling Contractors by Hughes Tool Company.

	Dec. 15	Dec. 22	Dec. 29	Jan. 5
Alabama	13	10	10	8
Arkansas	24	23	24	15
Arizona	1	1	0	0
California—Land	98	89	85	82
California—Offshore	—	—	—	5
Total California	98	89	85	87
Colorado	38	39	38	31
Florida	0	0	0	1
Idaho	0	0	0	0
Illinois	50	55	49	42
Indiana	8	9	7	2
Iowa	3	3	3	3
Kansas	174	180	151	141
Kentucky	8	9	8	6
North Louisiana	40	37	36	37
South Louisiana—Inland Waters	140	115	138	138
South La.—Land	42	39	38	32
South Louisiana—Offshore	42	39	39	32
Total Louisiana	334	293	325	329
Maryland	1	0	2	2
Michigan	13	12	9	12
Missouri	1	1	1	1
Montana	27	21	19	18
Mississippi	66	70	65	57
Nebraska	22	20	20	19
Nevada	0	0	0	0
New Mexico	103	101	97	102
New York	1	1	0	0
North Dakota	30	36	32	33
Ohio	3	3	2	2
Oklahoma	272	263	234	194
Oregon	0	0	0	0
Pennsylvania	9	9	9	10
South Dakota	0	0	0	0
So. Tex. & Gulf C.—Inland Waters	6	6	6	4
So. Tex. & Gulf C.—Land	210	219	180	150
So. Tex. & Gulf C.—Offshore	2	2	1	2
North and East Texas	178	202	189	168
West Central Texas	341	358	326	301
West Texas	173	166	164	159
Total Texas	901	953	866	784
Utah	38	38	34	35
Washington	0	0	0	0
West Virginia	1	2	3	3
Wyoming	81	82	78	68
Total U. S.	2321	2356	2171	2005
Western Canada	193	208	193	193
Eastern Canada	1	1	0	0
Grand Total	2515	2565	2364	2198

You asked for it! Here it is—


WHAT MAJOR ITEM OF EQUIPMENT NEEDS IMPROVING THE MOST?
"The PETROLEUM ENGINEER" conducted a wide survey of the Drilling Contractors, which was reported in the October 1958 issue. When asked the question, "What major equipment needs improving most?" 53% SAID PUMPS! "They need to be lighter, smaller in dimensions and pump larger volumes at higher pressures . . . The weight and size of present pumps are a serious burden to contractors operating at all depth ranges."
Courtesy "The Petroleum Engineer"
53%
14%
11%
9%
8%
2%
2%

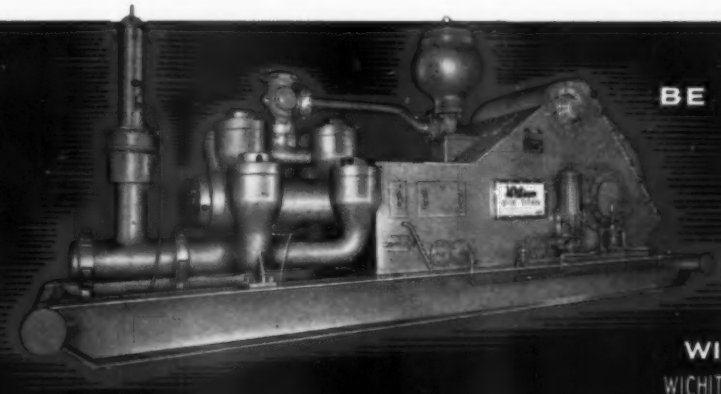
the new WILSON PUMPS again YEARS AHEAD in design

The Wilson Giant (300-600 HP) and Titan Pumps (700-1250) provide . . less downtime . . less expense for repairs . . less time out to change valves, pistons, rods, liners . . and have been field tested for four years. Next time you need a pump call your nearest Wilson Salesman, or call factory collect . . for a Wilson proposition before buying any pump! And remember, the Wilson cost per horsepower is one *third less* than the average of other pumps.

YOU ASKED FOR LIGHTER WEIGHT: **The Wilson Titan pump is half the weight per horsepower of an average of 12 pumps in the same horsepower class. The average weight per horsepower of the 12 pumps is 56 pounds per horsepower. But the Wilson Titan weighs only 28 pounds per horsepower, both at the speed they can actually be run.**

YOU ASKED FOR SMALLER DIMENSIONS: **Both Wilson pumps are smaller than any other pump of the same horsepower.**

YOU ASKED FOR LARGER VOLUMES AT HIGHER PRESSURES: **The Wilson is the only modern chain drive pump designed to give large volumes, at high speeds and high pressures, and at high efficiencies!**



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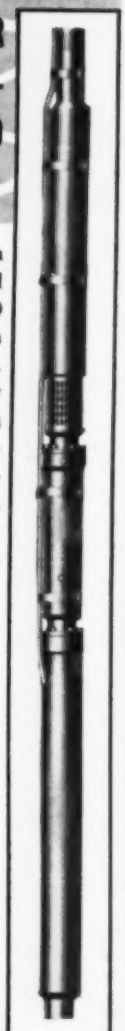

High capacity Reda Pumps produce fluid volumes up to 18,000 barrels per day from standard size casings. You can profitably produce wells with a high water-oil ratio. Investment cost per barrel of daily capacity is far lower when you choose REDA for high water-oil ratio wells.

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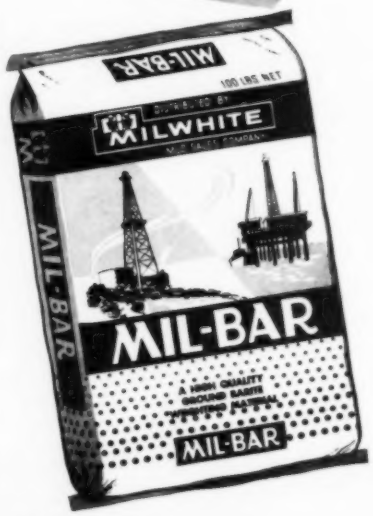

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Huge Offshore Platform Will Lay Ocean Pipeline

The world's largest mobile offshore platform, "George F. Ferris," just clears the 232-ft span of Golden Gate Bridge as it heads for Los Angeles, where it will be used to assemble the record-size Hyperion ocean sewer pipe in 200 ft of water.

It will lower 600-ton assembled sections of pipe to the ocean floor, connect with previously laid sections, and then back fill around them with a cradle of gravel. After each 192-ft long pipe section is laid, the rig "walks" ahead by first jacking down its platform on the legs until the entire unit is floating. Then it winches itself ahead to the next pipe position, lowers its legs, and lifts itself above reach of waves to repeat the pipelaying sequence.

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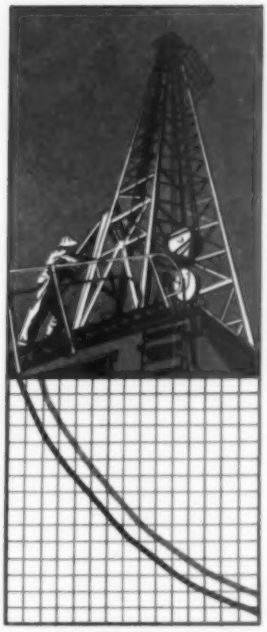

In 1958, profits dropped nearly $2,000,000,000 because of *corrosion*, much of it due to *corroded* pipe lines!

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SWP-11

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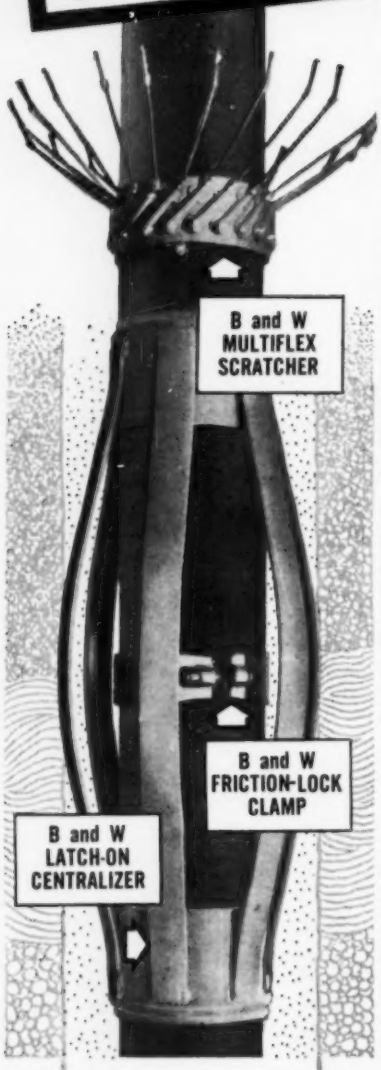

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123

RUNNING TOUR with MEN in the INDUSTRY

▸ **Dr. Charles E. Weaver** of **Shell Development Company** received a high professional honor at the annual meeting of the National Geological Society. He was the recipient of the Mineralogical Society of America Award. Dr. Weaver's work has been concerned with the application of mineralogical and geochemical techniques to the search for oil.

▸ **Jimmy W. Wilkins** well-known West Texas oil drilling and service contractor, has formed a new business partnership with **E. H. (Doc) Wilkins,** known as the **Permian Servicing Co., Inc.** and **D & G Drilling Co.,** Levelland and Andrews, Texas.

▸ **A. C. Baker,** formerly district geologist at Wichita Falls, Texas for **Tennessee Gas Transmission Company** has been transferred to Denver as district geologist, replacing **Ray Marvin.** Marvin has been named geologist senior. **Robert G. Welch,** formerly geologist at Wichita Falls will replace Baker.

Don Griffith, district landman at Wichita, Kansas, has been transferred to Shreveport to serve in the same capacity in that exploration district. **A. E. Feist** has been employed as district landman at Casper, Wyoming. He replaces **E. T. Creegan,** recently promoted to district exploration manager at Wichita Falls. **Gordon Ashbury Jr.,** formerly landman junior at Durango, Colorado, has been promoted to landman and transferred to the Wichita, Kansas, district.

▸ **James Ryan Walker** has been employed as staff geophysicist with **Murphy Corporation.** He was previously a geophysicist consultant in Shreveport, Louisiana.

▸ **Stephen G. Dardaganian,** petroleum engineer, has joined the firm of **H. J. Gruy and Associates,** petroleum consultants. He was formerly associated with Atlantic Refining Company in Lafayette, Louisiana.

S. G. Dardaganian

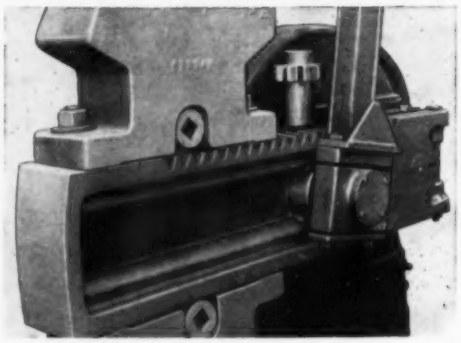
R. E. Old Jr.

▸ **Robert E. Old Jr.** has been appointed as general manager for **Stekoll Petroleum Company's** Venezuelan exploration and production operations. Old has extensive overseas experience, more than six years of it in Venezuela as reservoir engineer and assistant production manager for Socony-Vacuum.

▸ **Wilbur B. Sherman** has been elected president of **Pan American Land & Oil Royalty Company** of Dallas. He was formerly a vice president and director of DeGolyer and MacNaughton, Inc.

▸ **Truett Helms Jr.,** has been appointed manager of **Southern Union Gas Company's** land department in Dallas. He was formerly landman in the geological and exploration department.

MAXIMUM EFFICIENCY...



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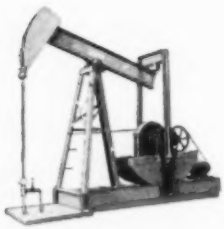

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JENSEN JACKS

▸ **A. S. Johnson** has been appointed district superintendent for the Dubach, Louisiana district of **Southwest Gas Producing Company, Inc.** He was formerly assistant superintendent.

▸ **Paul W. McFarland** has been appointed manager of the **Sun Oil Company's** Latin America production division. He succeeds Benton E. Warren, who died recently. **Lee C. Smith** replaces McFarland as exploration manager for the division.

▸ **Ed Houston** has been promoted to general superintendent for **Jake L. Hamon,** independent producer, Dallas, Texas. Houston, formerly Hamon's South Texas and Louisiana division superintendent at Freer, succeeds **Jefferson S. Ewing,** who retired in January. **Chester Phillips,** formerly West Texas division superintendent (Midland) has become South Texas and Louisiana superintendent. **Howard Shaw,** formerly West Texas division engineer for Hamon, was promoted to West Texas superintendent. **P. P. Pittman,** Freer, was transferred to Midland, as West Texas division engineer.

W. E. Ferguson

▸ **William E. Ferguson,** vice president and manager of production of the **Ohio Fuel Gas Company,** has retired after a career of 41 years in the natural gas industry. He was a member of Ohio Fuel's board of directors, a director and member of the executive committee of the Preston Oil Company.

▸ **Phillips Petroleum Company** has opened an office in Algiers, Algeria, for the operation of concessions in the French Sahara. The staff consists of **Dwight H. Smith,** division geophysicist; **S. O. Eha,** division geologist; and **D. G. Sidebottom,** office manager.

Smith was formerly geophysical party chief in various locations, Eha was foreign staff senior geologist located in Bartlesville, Oklahoma, and Sidebottom was chief clerk in Maracaibo.

▸ **Jaye F. Dyer** has joined the staff of **Apache Oil Corporation** as division geologist in charge of new areas. Dyer formerly was exploration manager for Anderson-Prichard Oil Corporation.

▸ **B. J. (Bill) Robbins,** drilling superintendent for **Barnwell Offshore Inc.** at New Orleans, has been elected a vice president and appointed general manager of the Gulf Coast area.

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HERCULES Duplex Polished Rod Stuffing Boxes are constructed from high grade malleable iron (55,000 PSI Tensile Strength) and are rated 3,000 pound test. Flexibility and the cone-shaped Packing Rings are the combination of factors which make the HERCULES Stuffing Box without equal for any pumping situation.

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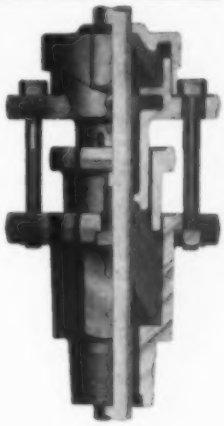
*Any HERCULES Stuffing Boxes may be equipped with Oil Reservoir Upper Glands on "problem" wells which pump-off and burn packing. The polished rod moves through the oil in the reservoir which lubricates and cools it.

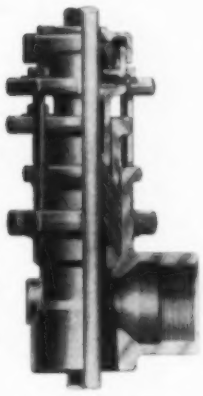
"REGULAR TYPE" DUPLEX POLISHED ROD STUFFING BOX

The old reliable; tried and proved on thousands of wells from coast to coast and in many foreign fields.



"TEE TYPE" DUPLEX POLISHED ROD STUFFING BOX

HERCULES "TEE TYPE" Stuffing Box is very compact, only 15" high. It is full opening which allows rods to be run or pulled without removing Stuffing Box body. It is furnished in 2", 2½" and 3" sizes with any API Tubing or Line Pipe Thread.



"TYPE DP" DUPLEX POLISHED ROD STUFFING BOX

A double packed Stuffing Box for use on high pressure wells and those that flow intermittently. Especially desirable for wells located near buildings, fire hazards or growing crops. Two compression bolts, in bottom sections, are tightened on lower packing set while replacing packing in upper section. Possess same flexibility as the regular and Tee base type.

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GENERAL OFFICES AND PLANT
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Export Representative: Oil Field Equipment Co., Inc., 90 West Street, New York 7, N. Y.

FOR FURTHER INFORMATION ON ADVERTISED PRODUCTS, SEE READER SERVICE CARD

Running Tour

▸ **L. L. Handy** has been appointed to the position of senior research chemist, producing technology and secondary recovery division for the **California Research Corporation.** He joined the company in 1951. **R. J. S. Brown** has been appointed to the position of senior research physicist, well logging and basic producing research division. Brown has made many contributions on both basic and applied problems in the field of nuclear magnetic resonance since joining California Research in 1953.

▸ **J. M. Taylor** has been appointed manager of **Canadian Pacific Oil and Gas Ltd.** He was formerly with C.P.R.'s department of natural resources.

▸ **Dr. W. C. Gussow** has been appointed to the National Advisory Committee on research in the geological sciences — a federal group sponsored by the Department of Mines. He is with **Union Oil Company of California.**

▸ **Donald L. Redman** has been elected vice president-operations and re-elected to the board of directors of **Central-Del Rio Oils Limited.** He was formerly manager of operations.

▸ **T. M. Cady** has been promoted to the newly created position of special representative, exploration department, southwestern region for **Continental Oil Company. Wade E. Thomas,** assistant regional land superintendent, will succeed Cady as regional land superintendent.

▸ **Edwin C. Holmer** has been appointed manager of the production division of **Jersey Production Research Company** in Tulsa, Oklahoma. He was previously an assistant director of the chemicals research division of the Linden research laboratories, Esso Research and Engineering Company.

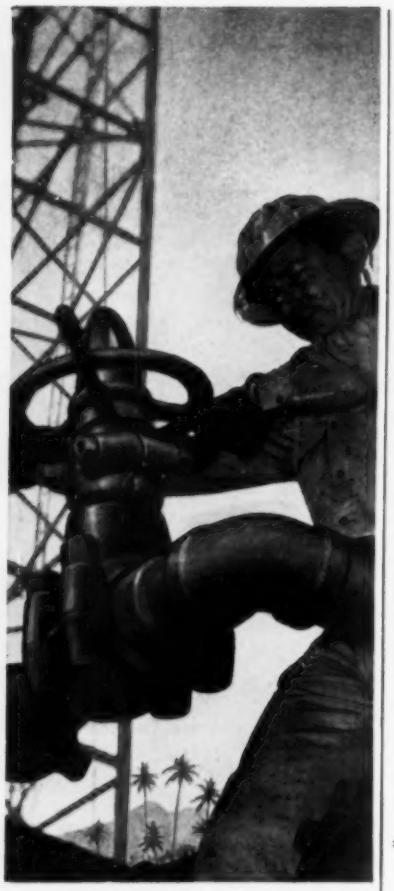
▸ **John N. Gray** (center) and **Wallace H. Cochrane** (left) have formed the **Gray Cochrane Corporation,** petroleum consultants with offices in the Johnson Building,

Denver, Colorado. Gray resigned as district superintendent with Sinclair Venezuelan Oil Co. and Cochrane had been an independent geological consultant in Denver. **Edward R. Haymaker,** (right) previously a consulting engineer with Ball Associates, has joined the company as reservoir-evaluation manager.

▸ **Paul D. Noll** has resigned as assistant general superintendent of drilling and production for **Freeport Oil Company,** and has opened a consulting office in the NBC Building in New Orleans.

▸ **David B. Schulz** has joined **B B M Drilling Company** as West Texas division drilling superintendent. Starting as a roughneck, he came up through the ranks to tool pusher, drilling engineer, and drilling superintendent with George P. Livermore, Inc., Lubbock and Dixon Drilling Company of Abilene, Texas.

▸ **Joseph P. D. Hull Jr.,** has joined **Kerr-McGee Oil Industries, Inc.,** as staff exploration geologist in the Oklahoma City headquarters office. He formerly was associated with Humble Oil and Refining Company at Midland, Texas.



Making Mud Behave

Drilling mud can destroy an ordinary valve. Control of the highly abrasive, pulsating pressure in mud lines was a constant bother until Cameron perfected the Flex-Seal Mud Valve some twenty years ago. This design was an instant success. Today the same valve with certain innovations is saving time and money on almost every drilling rig in the world. New parts interchangeable with the original design make the Flex-Seal rigid during repair and extend its already remarkable resistance to wear.

For durability, ease of repair and all-round economy, esp.cially on remote locations, COUNT ON CAMERON Flex-Seal Mud Valves, the driller's friend for twenty years.

Flex-Seals are manufactured in the United States, England and France.

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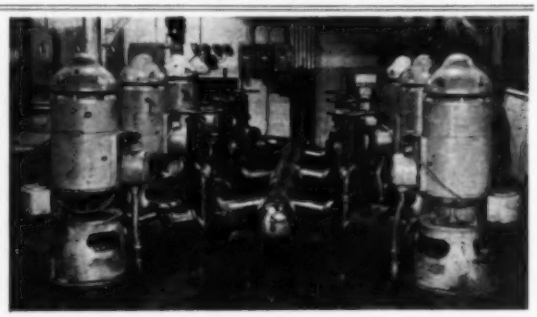
3 times the capacity in one-third the space...



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THE OASIS—

A gathering spot for NOMADS

A large group of international visitors attended the November meeting of the Houston chapter of Nomads. They were: (standing) J. C. Robbins, Iran Oil Company, Iran; Oscar Gonzalez Ugaz, Impresa Fiscales de Peru, Peru; Jim Daive (rear), Iraq Petroleum, Iraq; John Hobson, Iraq Petroleum; Mark Glover (rear), Cameron Iron Works, Venezuela; R. E. Bates, Baroid, Maracaibo; John Fuller, Planet Exploration, Australia; P. W. Cooke, Magnet Cove Barium, England; J. Rastagar, National Iranian Oil, Teheran; R. Reyes, Hughes Tool, Mexico City; Raydivaldo Ribeiro, Petrobras, Brazil; Orisan Almeida, Petrobras, Brazil; Carlos Alvez, Petrobras, Brazil; Carlos Periera, Petrobras, Brazil.

(Seated) M. Hessabi, National Iranian Oil, Teheran; B. Naderi, National Iranian Oil, Teheran; J. Lahrrere, CFPA, Algeria; Maurice Escole, CFPA, Algiers; Padilha de Luz, Petrobras, Brazil; Helio Rosado, Petrobas, Brazil; Jean Frayssinet, Iraq Petroleum, Baghdad; Eladio Lima, Petrobras, Brazil; Bob Lingwood, Iraq Petroleum, Baghdad.

Not shown: Brinton McKeown, Kuwait Oil, Kuwait; C. Calamasi, Gulf Oil Sicily, Palermo, Sicily; L. Chunn, Gulf Oil, Sicily, Palermo; Frank Allaire, Cameron Iron Works, Argentina; C. Montiero, Petrobras, Brazil; R. E. Souther, Baroid, Caracas.

Members of the IPE Nomad committee try out a portion of the newly redecorated international headquarters on the show grounds. The building will be the meeting place for all international visitors and Nomads. Facilities will be available for almost anything the overseas visitor should want — from interpreters to travel changes to chauffeured automobiles. In the picture are: Oscar B. Irizarry, Petroleo Interamericano, Tulsa chapter president; Arch F. Campbell, retired, headquarters manager; Don L. Collins, Republic Supply, IPE committee chairman; H. M. Cooley, Bethlehem Steel; Ken O. Hoevel, National Supply; R. C. Glover, Baker Oil Tools; Bill Davidson, W. C. Norris and Gilbert Swift, Well Surveys, Inc.

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over 35 years of proven superiority... a record of less costly maintenance, "down time", stoppages and repairs than any other make.

MARVEL extra-fine lubricant is specifically designed to keep engines at peak efficiency under all the "engine-killing" conditions... in an oil field.

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TO BE SURE OF "ROUND-THE-CLOCK" PROTECTION.
Feeds MARVEL Mystery Oil in exact proportion to engine speed and load.

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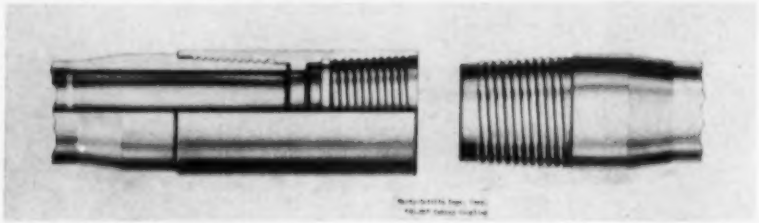
Drilling – Producing Equipment

Tubing Joint Has Teflon Seat



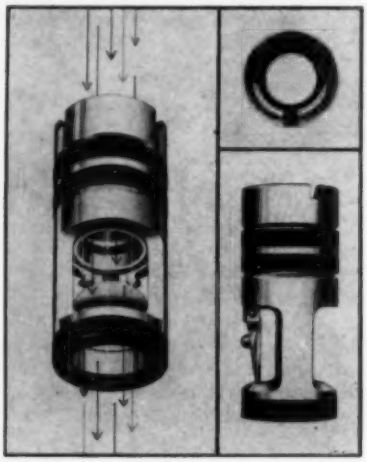
Hardy-Griffin has introduced a new dual seal coupling joint which features an especially developed thread form and a Teflon soft seal. The joint is designed to withstand greater internal pressure than the nominal body of the tube.

The Teflon soft seal, placed in the lower end of the box, receives full compression against the nose of the pin and the base of the coupling box by a one-half turn of the connection after it is hand tight. The joint also makes a metal-to-metal seal on the thread shoulders, leaving the crests unengaged. *Hardy-Griffin Engineering Corporation.*

Circle number (1) on reply card.

Drill Pipe Float Valve Is Full Opening

A Baker-developed flapper valve, that provides a positive seal against back-pressure yet opens fully during circulation, permits drilling fluids to flow through the float with diversion. This operation eliminates abrasive wear to the float or to the



inside diameter of the drill collar. The float is also provided with a series of vibration dampeners at key points. The valve is highly sensitive to changes in circulation flow of drilling fluids: The flapper valve closes immediately circulation is stopped and opens again as the first joint is raised. *Baker Oil Tools, Inc.*

Circle number (2) on reply card.

World's Strongest Industrial V-Belts

Development of the world's strongest industrial V-belt, with 40 percent more pulling power than previous belts, has been announced by Gates Rubber Company. Three of the belts will take the place of five belts of present design and will permit users to reduce the size of pulleys and floor space taken up by belt drives. *Gates Rubber Company.*

Circle number (3) on reply card.

Weight Indicator and Sensing Element Combined

The Martin-Decker Type F weight indicator is available with the company's "Sensater" sensing element as an integral part of the wire-line anchor. The sensing element realizes every weight change immediately through a nylon-reinforced diaphragm unaffected by temperature changes. It derives its sensitivity from a specially designed diaphragm which makes a stroke similar to a piston's travel. *Martin-Decker Corporation.*

Circle number (4) on reply card.

BS&W Monitor

Garrett Oil Tools is manufacturing a new BS&W monitor which features a simplified circuit design, high accuracy, and easy maintenance. Licensed under Gulf Research & Development Company patents, the unit responds to change of the dielectric constant of fluids passing through the probe and has a range of 0 to 3 percent. Instruments can be provided with a smaller or larger range and special recording instruments are also available. *Garrett Oil Tools, Inc.*

Circle number (5) on reply card.

Diesel Line Ranges From 20 to 1650 Hp

Detroit Diesel Engine Division of General Motors has added 8 new units to its line of 2-cycle engines for an expanded line total of 13 basic engines and 6 multiple-engine units. Among the new engines are 5 "V-type" engines which offer greater horsepower in a relatively more compact package. GM Diesel now has more than twice the number of basic single engine units in its line, ranging from 20 to 675 hp with overlapping continuous ratings throughout the range. Twin and turbopowered units boost the power range to 1650 hp. *Detroit Diesel Engine Division of General Motors.*

Circle number (6) on reply card.

New Geophone Line Features Long Life

SIE has announced the introduction of its new S-23 geophone, designed to combine high performance and easy field

service. Standard models have natural frequencies ranging from 7 to 75 cps and are available to special order. The geophones are contained in a hermetically sealed steel case containing an inert gas to prevent condensation. *Southwestern Industrial Electronics Company, a division of Dresser Industries, Inc.*

Circle number (7) on reply card.

Personnel Boat Features New Hull Design

A new hull design has been revealed in a personnel boat announced by Higgins, Inc. The vessel is built of aluminum and is driven by gas-turbine engines. The hull form, called "Polyhedral" by the builder, has longitudinal "breaks" which create a greater amount of deadrise than possible with conventional smooth skin bottom with the same area and depth. The 30-passenger boat can maintain speeds in the 40 mph range in 3½-ft waves. *Higgins, Inc.*

Circle number (8) on reply card.

Well-Test Data Recorder

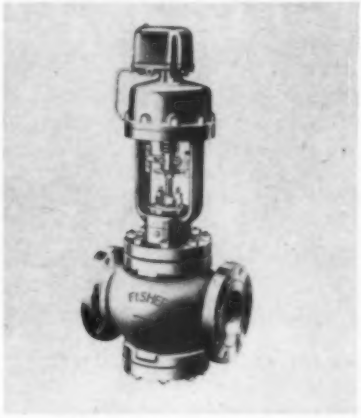
Garrett Oil Tools is manufacturing a print recorder designed to record and print well identification, date, time, and

accumulated test data with a maximum of 40 well identifications and four data channels. Information is printed on a roll of paper 10⅜-in. wide and may be prepared in up to 3 copies. The recorder may be equipped with an hourly print feature which indicates the hourly status of all data during the test period. *Garrett Oil Tools, Inc.*

Circle number (9) on reply card.

High Pressure Pneumatic Piston Operator

Fisher Governor has released its new high pressure pneumatic piston operator, Type 470 "P.O.P." The equipment was designed for more force and higher stroking speeds than available from diaphragm operators. It operates on any supply pressure up to 150 psi and creates stem forces



from 1500 to 12,000 lb. Stroking speeds range up to 1.5 in. per sec. *Fisher Governor Company.*

Circle number (10) on reply card.

High Capacity Diesel Electric Plants

Eight new series of diesel-driven electric generating plants, from 50,000 to 200,000 w, have been announced by D. W. Onan. Each plant of the series is a complete, self-contained electric generating set with the diesel engine, alternator, exciter, and control panel assembled into one compact unit. A complete selection of optional accessories including automatic line transfers is available for each model. *D. W. Onan & Sons Inc.*

Circle number (11) on reply card.

Lube-Line Alarm

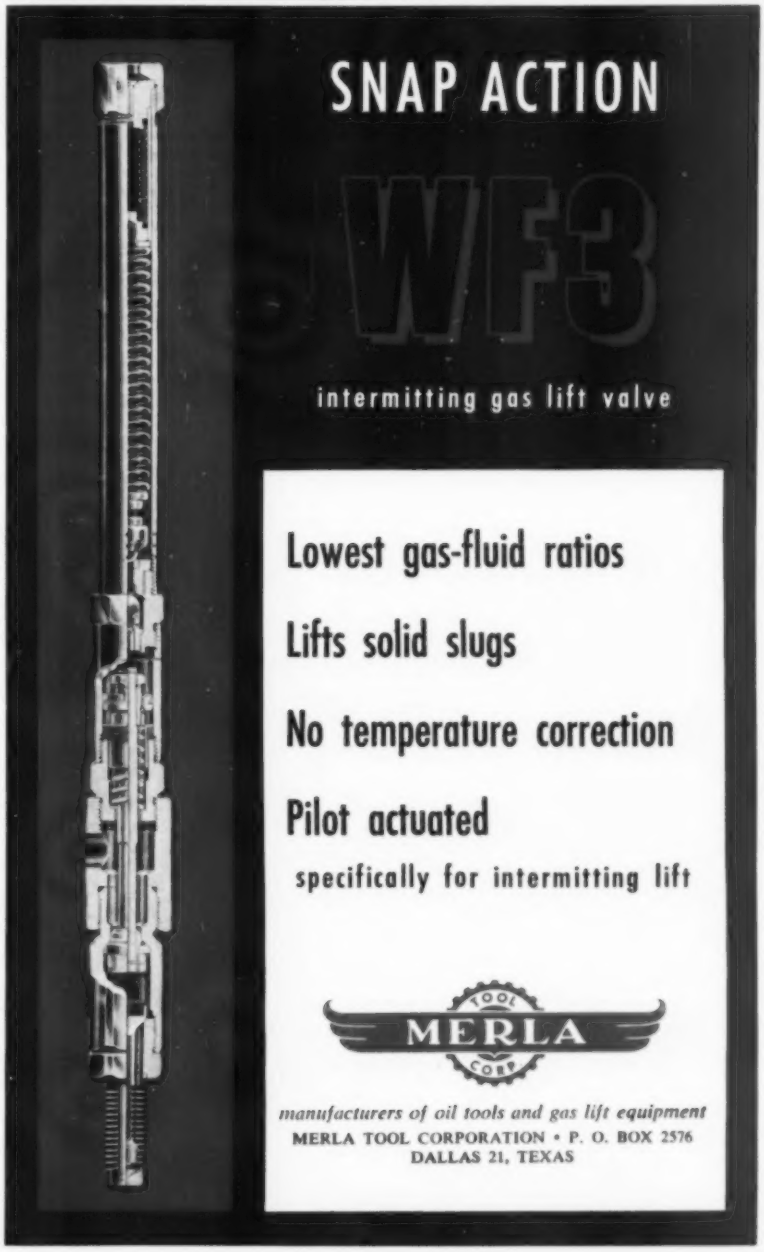
A new protective device for use on force-feed lubricating systems has been announced by Manzel. Called "Lube-Line Alert," the unit is installed at each terminal point of lubrication and connected electrically to any desired warning device. If flow of lubricant through the unit is interrupted for any reason, the signalling system is activated. The system is designed for pressures up to 10,000 psi. *Manzel, a division of Houdaille Industries, Inc.*

Circle number (12) on reply card.

Heavy End Aluminum Pipe

The introduction of heavy end aluminum pipe has been made by Reynolds Metals. The pipe offers increased strength and thickness at pipe ends where welded or threaded joints are made and utilizes less metal in the pipe body. Presently offered in selected sizes equivalent to many standard Schedule 40 and 80 sizes, the extruded pipe can be readily produced to individual specifications. *Reynolds Metals Company.*

Circle number (13) on reply card.



New Equipment

Pumping Motor Line Expands

New and larger sizes of Green Triangle electric motor are being distributed by Continental-Emsco. New sizes are 40, 50, and 75 hp. Also available are 900-rpm motors for pumping with single-reduction gear-reducer pumping units, available in sizes from 3 to 20 hp. *Continental-Emsco.*

Circle number (14) on reply card.

Wire-Line Retrievable Gas Lift Valve

Merla Tool has developed a new wire-line retrievable gas lift valve especially designed for wells where trash and mud are a problem. The valve, the WF1OR, features a direct-acting valve with full-opening port which eliminates collection of trash. *Merla Tool Corporation.*

Circle number (15) on reply card.

Full-Opening Casing Head

Development of a full-opening casing head for 2000 psi working pressure has been announced by National Supply. The head, Type G, includes a demountable flange, and employs pressure-actuated packing that assures positive seal without need of precise manual adjustments. The body has two 2-in. outlets and is supplied either with a counterbore for weld or with API male casing thread lower connection. The full-opening body accommodates all drilling tools. *The National Supply Company.*

Circle number (16) on reply card.

Drilling-Producing Literature

Oil Well Pumping Manual

Harbison-Fischer has issued a new publication, "Methods of Oil Well Pumping," which discusses such topics as reservoirs, sub-surface pressure, design of sucker rod strings, various types of pumps, and methods of calculating pumping installations. The manual also includes sections of API codes and recommended field practices. *Harbison-Fischer Manufacturing Company.*

Circle number (17) on reply card.

Industrial Enclosed Switches Catalog

Newly revised Catalog 83c, covering a complete line of industrial enclosed switches, has been released by Micro Switch. The catalog covers the complete line of industrial enclosed and heavy-duty limit switches and gives details of 9 housing groups of metal-enclosed switches for industrial uses. *Micro Switch, a division of Minneapolis-Honeywell Regulator Company.*

Circle number (18) on reply card.

Brochure Illustrates Offshore Platforms

A colorful 12-page brochure has been prepared to describe 3-legged offshore oil drilling platforms built by R. G. LeTourneau, Inc. Included is a rundown of how the big "portable islands" are constructed, where they are working, and various performance records established by their operations. *R. G. LeTourneau, Inc.*

Circle number (19) on reply card.

Bulletin Gives Gas Turbine Experience

A bulletin published by Clark Bros. details operating experience with the Mark TA 750/1000-kw gas turbine. Design features, types of fuels, plus applications in oil fields and process industries are thoroughly discussed. *Clark Bros. Company.*

Circle number (20) on reply card.

Nickel Cadmium Storage Batteries

New NICAD bulletin assists in selection of heavy-duty nickel cadmium storage batteries for industrial engine starting and stand-by power applications. The illustrated, 4-page bulletin provides detailed selection data on batteries designed for starting diesel and gasoline engines, supervisory control emergency lighting, and switch tripping. *NICAD Division, Gould-National Batteries, Inc.*

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OIL INDUSTRY PROGRESS... *powered with*

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DIAMOND ROLLER CHAINS

Bulletin Describes Well Control Equipment

Merla Tool has published a new bulletin describing time and pressure controlled surface intermitters and motor valves used for gas lift control, stop-cocking flowing wells, and regulating back pressure. Cutaway illustrations are shown with detailed information on construction, use, and performance figures. *Merla Tool Corporation.*

Circle number (22) on reply card.

Magnetic Drill Stand Bulletin

A new 4-page bulletin on the use of magnetic drill stands is available from Thor Power Tool Company. Three magnetic drill presses, for air or electric drills up to 2-in. capacity, utilize magnetic bases which "lock" to any ferrous surface. *Thor Power Tool Company.*

Circle number (23) on reply card.

Fiberglas Ring Gasket Brochure

Plastic Engineering & Sales has printed a brochure describing the company's ring joint gasket molded of fiberglas and special synthetic resins. The ring, which withstands compression pressures in excess of 60,000 psi and internal pressures in excess of 15,000 psi, can be used as an insulating gasket or as a replacement for the mild steel gasket. *Plastic Engineering & Sales Corporation.*

Circle number (24) on reply card.

Integral-Shaft Sheave Bulletin

Construction and operating features of Vari-Pitch integral shaft sheaves for stepless speed control in large machine drives are given in a new bulletin released by Allis-Chalmers. The bulletin describes how integral-shaft sheaves are available with lubrication systems designed and engineered to assure distribution of lubricants to all moving parts. *Allis-Chalmers Manufacturing Company.*

Circle number (25) on reply card.

Remote Reading Liquid Level Gages

A new 8-page catalog covers in detail the complete line of Jerguson Truscale gages including standard, red flasher, and inclined styles. These gages are for remote liquid level indication. Information on styles, models, and datum columns assist in selection. *Jerguson Gage & Valve Company.*

Circle number (26) on reply card.

Catalog Lists Completion and Wellhead Equipment

A new 56-page catalog from McEvoy presents information on valves, multiple completion equipment, and wellhead equipment. Also included is information on miscellaneous equipment such as API flanges, ring gaskets, studs and nuts, etc. *McEvoy Company.*

Circle number (27) on reply card.

Air Compressor Literature

A new 12-page bulletin describing Westinghouse unit type air compressors has been issued by the Le Roi Division. The bulletin describes G single-stage, YS single-stage, and YC two-stage compressors ranging in size from ½ to 15 hp. Available pressures are from 80 to 250 psi. Specifications list CFM displacements, pressures, weights, dimensions, and rpm of the various models and sizes. *Le Roi Division, Westinghouse Air Brake Company.*

Circle number (28) on reply card.

Bulletin Covers Fracturing Services

BP Service has published a new bulletin which covers the company's fracturing services. The bulletin discusses each fracturing fluid and temporary blocking material used and compares the friction loss of the fluids in both tubing and casing. A glossary of terms used in well-stimulation work is also included. *BJ Service, Inc.*

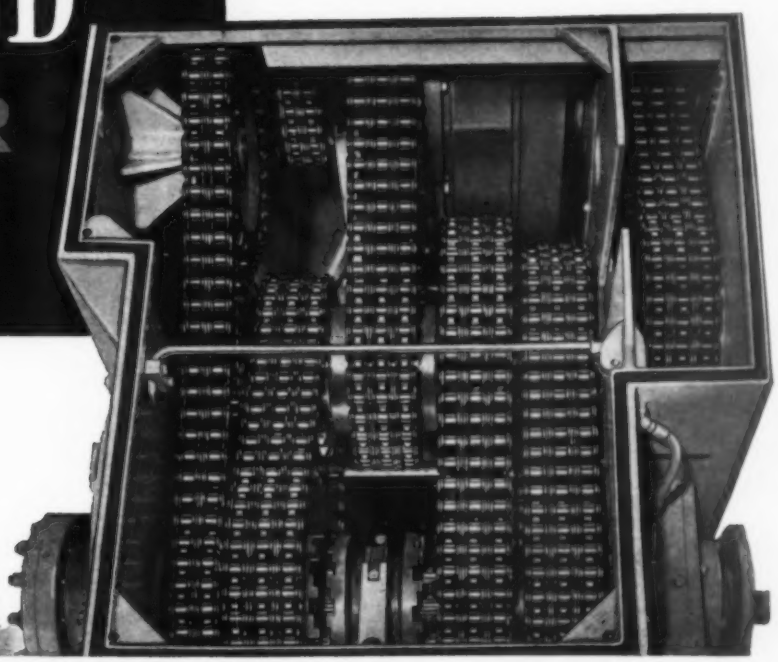
Circle number (29) on reply card.

Magnetic Flowmeter

A bulletin from Fischer & Porter describes the use of magnetic flowmeters in measuring the flow of drilling mud. The bulletin shows a typical installation and analyzes a representative chart from the meter. *Fischer & Porter Company.*

Circle number (30) on reply card.

DIAMOND ROLLER CHAIN



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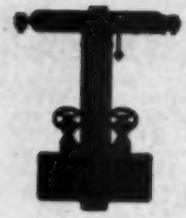

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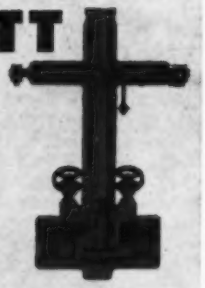

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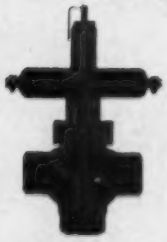

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For detailed information, write for Catalog No. 256 MVC.

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Industry Cool To Atom Blast In Oil Shale

Oil industry scientists and engineers attending the recent Nuclear Explosions and Oil-Shale Utilization meeting expressed vital interest — but made no commitments — in the government's proposal to unlock the nation's oil shales reserves using a thermonuclear device. The two-day meeting in Dallas, Texas, January 6 and 7 was attended by 125.

The "preliminary" planning meeting, sponsored by the Atomic Energy Commission and the U. S. Bureau of Mines, brought forth a proposal by the government for oil industry's financial support in the "Plowshares" — atoms for peace — program.

This marks the first offering by the government to detonate an atomic device for purely commercial purposes.

The AEC and Bureau of Mines propose to set off an atomic explosion, on the order of 10 kilotons, in a yet-to-be-decided-upon area. Several sites in the Piceance Creek Basin region of Garfield and Rio Blanco counties, northwestern Colorado, were discussed at the meeting.

The blast, if successful, would change present methods of oil shale recovery. The blast could eliminate the need for mining, except for site preparation, eliminate shale preparation in plant facilities, and in effect, construct an underground retort already charged with broken shale.

The AEC, under a proposed plan submitted to the oil company representatives, would furnish $1,000,000 toward the project; the Bureau of Mines would contribute $400,000; industry would be expected to contribute an additional $1,200,000 to the project.

The offer is being formally submitted to oil company management by letters from the Bureau of Mines. Acceptance of the plan will not be known until replies have been tabulated. Some attending the meeting suggested the proposal contained "too many unknowns," and questioned the amount of oil that could be profitably separated from the oil shale through the blast.

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POSITION WANTED

Available March 1, Mechanical Engineer with three years' experience in Western Venezuela in production, new well completions, workovers, sand control and stimulation. Single, 25 yrs., enjoys contact with people and promotion work. *Prefers employment in Venezuela, based in Caracas or Maracaibo.* Box 207, c/o The Petroleum Engineer, P. O. Box 1589, Dallas, Texas.

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Procon engineers will be glad to consult with you.

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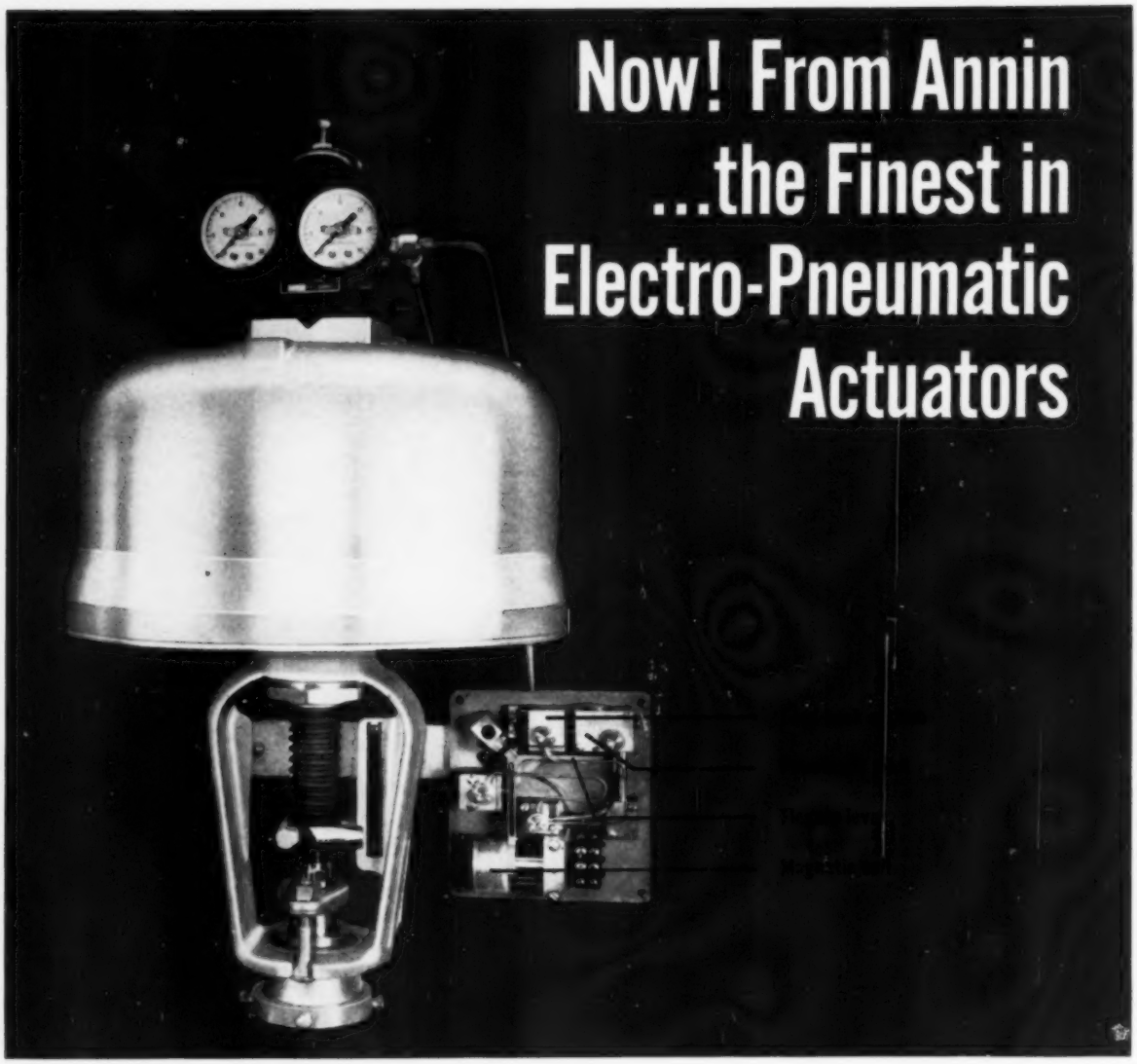

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Annin's Model 30,000 transducer, coupled with the Annin Domotor, gives you greater range of adjustment, unequalled stability, and exceptional dynamic characteristics

The Model 30,000 has been developed to provide process engineers with a practical transducing element for converting a small electrical signal to an accurate and stable pneumatic output pressure. It embodies only four basic sub-assemblies, which minimize motion and wear, simplify adjustment and installation. The Model 30,000 features full-scale zero adjustment and a wide range of span settings for split range and sequencing applications. Absence of complex components, together with minimum installation,contribute to low maintenance. Linearity and accuracy reach a new high in electro-pneumatic transducing with the Model 30,000. *Technical data on request*

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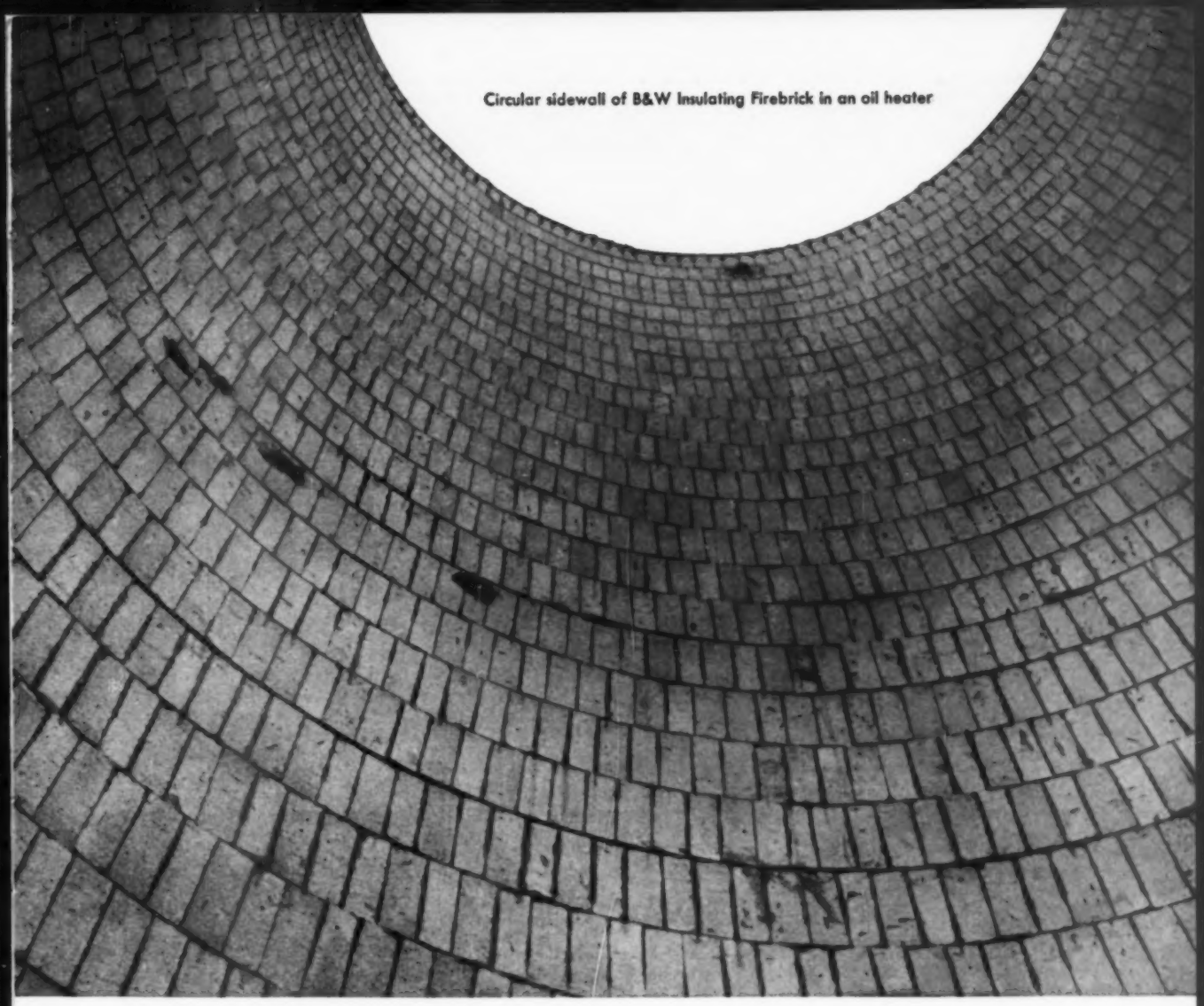

Circular sidewall of B&W Insulating Firebrick in an oil heater

How B&W Insulating Firebrick cut processing costs

Here are four *key* reasons why B&W Insulating Firebrick reduce over-all costs in chemical and petroleum process furnaces:

High Hot Load Strength —B&W IFB provide maximum load-bearing capacity *under operating temperatures*. Many oil heaters have been built with walls 80 feet high *with no intermediate support*.

Low Heat Storage — Cost-cutting B&W IFB have the *lowest* heat storage of any insulating firebrick. Since B&W IFB cool off fast, they protect expensive alloy tubes in the event of forced shut-down . . . make possible quick access to the furnace for inspection. They also reach operating temperature quickly, reducing cycle time and fuel bills.

Long Life — B&W Insulating Firebrick are *long* lasting because of the exceptional refractory nature of their base ingredients and the high processing temperatures to which they are subjected during manufacturing.

Short Installation Time —You save materially with B&W Insulating Firebrick because they are machined to size. They may be modified to fit door openings, peepholes, and other special conditions because they can be cut, drilled or shaped on the job with ordinary woodworking tools.

These sound reasons explain why process furnace builders and operators specify B&W Insulating Firebrick. Learn how these lightweight brick can help you save money. Your B&W representative will be glad to give you facts and figures.

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R-615

TABLE I

Effect of changing olefin distribution

(10% Light Olefins replaced by 10% Heavy Olefins)

CAR	DEPRECIATION, OCTANE NUMBER				
	1000 RPM	1500 RPM	2000 RPM	2500 RPM	3000 RPM
E	—	+ 1.1	+0.3	+0.7	+0.9
F	—	—	+0.4	+0.4	+0.5
R	+0.2	+0.4	+0.3	+0.5	+0.4
Average	—	+0.8	+0.3	+0.5	+0.6

The increase in octane number depreciation is shown above when 10 per cent light olefins (<210 deg. F.) are replaced by 10 per cent heavy olefins (>300 deg. F.). Cars E, F, and R are 11-to-1 C. R.

New study shows that the boiling range of hydrocarbons affects road antiknock performance

TWO GASOLINES with the same Research octane number, the same Motor octane number, and the same overall hydrocarbon type composition can differ significantly in road antiknock performance. This variation has been related to different placement of hydrocarbon types in the boiling range of gasolines.

Such was the general conclusion resulting from a program carried out at the Ethyl Research Laboratories in cooperation with a technical group of an oil company.

Why Such a Study

Research and Motor octane ratings are generally accepted specifications for gasoline antiknock quality. Laboratory octane number is both a convenient and simple means of control. Results are easily applied to refinery economic studies of motor fuel components.

But the basic refinery problem is to build into gasoline an octane quality that pays off in road performance. Considerable research in recent years has been aimed at empirically correlating laboratory tests with actual road ratings.

As a result, calculated road octane numbers are now accepted as a means of establishing relative road performance of gasolines.

Present road rating equations relate road performance

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to Research and Motor octane number and hydrocarbon composition. During the studies to formulate these equations it became apparent that, in addition to the hydrocarbon composition of the whole fuel, the distribution of the various hydrocarbon types in the boiling range was also significant.

Thus, fractional hydrocarbon effect became a logical subject for isolated study.

Fuel Design and Inspection

For this study, 20 fuels of 100 Research octane number were designed to the specifications in Table II. Each test fuel was blended to provide variations in hydrocarbon type in each of four boiling fractions—C_5-210 degrees F., 210-250 degrees F., 250-300 degrees F., and over 300 degrees F.

These four fractions comprised 40, 20, 20 and 15 per cent respectively of each blend. The remaining 5 per cent was normal butane to fill volatility needs.

Realistic gasoline components were used as shown by two example blends in Table III.

Comprehensive laboratory inspections of the fuels and fractions represented more than 700 laboratory antiknock ratings, 400 hydrocarbon-type evaluations, and complete volatility data.

Test Vehicles and Rating Procedure

Each of the 20 experimental gasolines was evaluated in six test vehicles. Three were 1957 and 1958 production models; the rest had experimental engines of 11-to-1 compression ratio.

Both Modified Borderline and Uniontown techniques were used in the rating program.

Effects of Hydrocarbon Fractions

The following specific conclusions were noted:

1. Low-boiling olefins (C_5-210 deg. F.) generally provide better road octane performance than do high-boiling olefins (over 300 deg. F.).

2. Low-boiling aromatics (less than 300 deg. F.) seem to perform better than high-boiling aromatics (over 300 deg. F.) at lower speeds in each car. There is no significant difference at higher speeds.

3. There are no significant differences in road octane number due to the distribution of aromatics between 250 deg. F., and 300 deg. F.

TABLE II

Fuel Specifications

1. Nominal Research octane number (RON) of 100.
2. Tetraethyllead concentration of 2.5 to 3.0 ml. per gallon.
3. Distillation temperatures at the 45%, 65% and 85% evaporated points of 210, 250 and 300 deg. F. respectively.
4. Volume of normal butane at 5 per cent.
5. Nominal Reid vapor pressure of 7 psi.

TABLE III

Composition of Test Fuel Fractions

Blend No.	C_5-210° F.	210-250° F.	250-300° F.	Over 300° F.
	% Component	% Component	% Component	% Component
11	28 Cat. Poly. 12 Pentene-2	20 Toluene	18 Straightrun 2 Normal Octane	15 Mixed Aromatics
18	32 HF Alkyl. Cut 8 Isohexane	8 Normal Heptane 2 Isooctane 10 Toluene	7 Straightrun 3 HF Alkyl. Cut 10 Mixed Xylenes	15 Cat. Poly.

Note: All blends contained 5% normal butane.

How Ethyl Research is helping you

As a part of their regular program, Ethyl Corporation's Research Laboratories are continually investigating the variables that affect road performance. Frequently, programs take the form of special studies for individual customers.

Other programs are for the benefit of the entire Industry and occasionally are studied jointly on a cooperative basis with other companies.

The project discussed above was reported in a joint technical paper at the S.A.E. National Fuels and Lubricants Meeting in Tulsa, Oklahoma, November, 1958. Reprints of this paper are available through your Ethyl Representative, or by writing Ethyl Corp., 100 Park Ave., New York 17, N. Y.

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Key to efficient operations . . .

Chromatographic Control of Magnolia's Alky Unit

Here's how one company is applying gas chromatographs to process control of alkylation and other units

L. J. McGovern and L. J. Carlisle Jr.
Magnolia Petroleum Company
Beaumont, Texas

DO YOU CONTROL your distillation columns or do they control you? At Magnolia's refinery in Beaumont, Texas, we thought that we controlled a deisobutanizer tower on an alkylation unit until we installed a process chromatograph. This chromatograph showed that composition of tower products varied over a wide range, even with the tower operating under seemingly stable conditions. This previously undetectable variation in product composition was costing the refinery several thousand dollars a month!

The deisobutanizer tower on the butylene alkylation unit was temperature-controlled, with pressure held constant. With a given feed composition, the end products of distillation are controlled by maintaining a constant temperature at some point in the system. In this instance, the reflux rate or heat output was kept constant, and the heat input from the reboiler used to maintain system temperature.

Prior to installation of the chromatograph, the operator would periodically sample tower product streams and send them to the laboratory for analysis. About five hours later the analysis report would arrive. Then, the big guessing game would begin. The analysis reflected operations as they were five hours ago. What allowances should be made for changes in feed charge rate, weather conditions, reflux temperature, and so forth?

Making mental allowances for past and anticipated changes, the operator would reset the temperature controller on the tower to zero in the desired split.

What product composition actually was during the five-hour lag was anyone's guess. Granted, they probably were in the general range desired, but in our case, this range influenced several thousand dollars a month in revenues.

Possible loss of revenues of this magnitude demanded attention. Accordingly, we installed a vapor phase chromatograph on the tower bottoms.

Deisobutanizer Tower Operation

A flow diagram of a deisobutanizer tower is shown in Fig. 1, along with stream compositions and product destinations.

The tower is designed to separate iso- and normal butane. Normal butane is undesirable in the overhead because it acts as a diluent in the alkylation reaction between isobutane and olefins. Isobutane is undesirable in tower bottoms because it increases vapor pressure of the tower bottoms, which are used to pressure motor gasoline. Each barrel of isobutane in gasoline displaces about 1.5 bbl of normal butane, resulting in a loss of total barrels of refinery gasoline.

However, some normal butane must go overhead and some isobutane must go out the bottom, the amount of each impurity depending on tower fractionation capacity and efficiency. Neither stream can be controlled for greater purity without sacrificing the quality of the other stream. The problem consists of evaluating the product streams to find an optimum split for maximum revenue gain and then controlling the tower to maintain this split.

Economic Evaluation Shows Losses

Revenue is plotted versus volume percent isobutane in the tower bottoms

*Adapted from a paper presented by the authors at the 1958 Annual Meeting of the Instrument Society of America, in Philadelphia, Pennsylvania. Permission of the ISA to publish this paper is gratefully acknowledged.

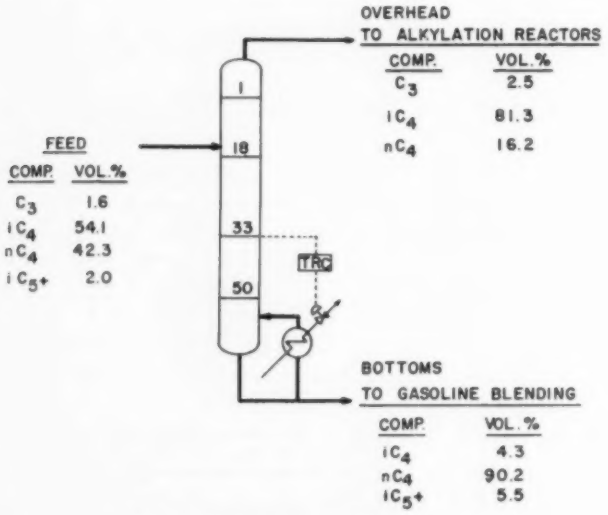

FIG. 1. Deisobutanizer material balance.

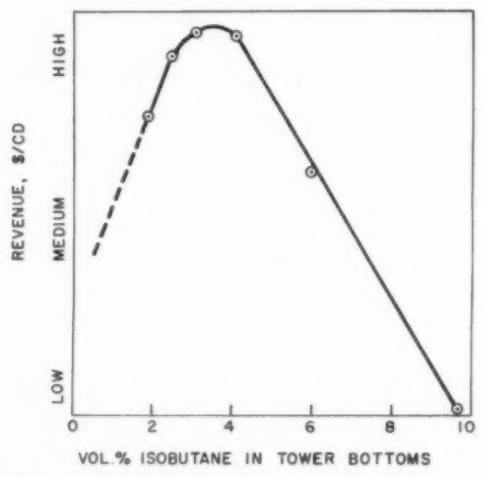

FIG. 2. Revenue vs percent isobutane in tower bottoms.

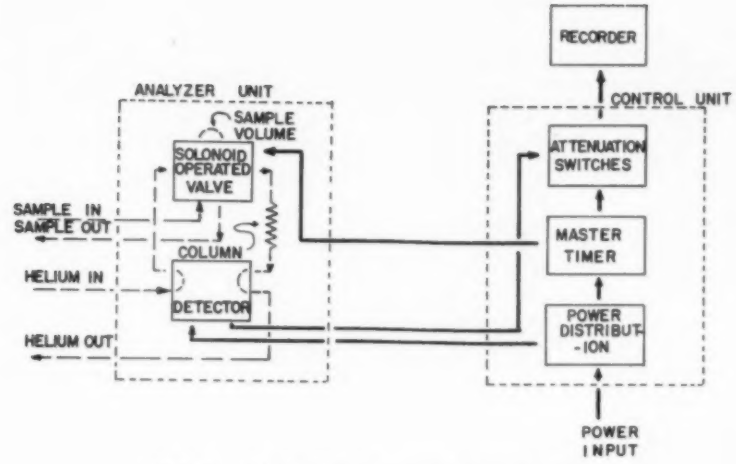

FIG. 3. Block diagram of a process chromatograph.

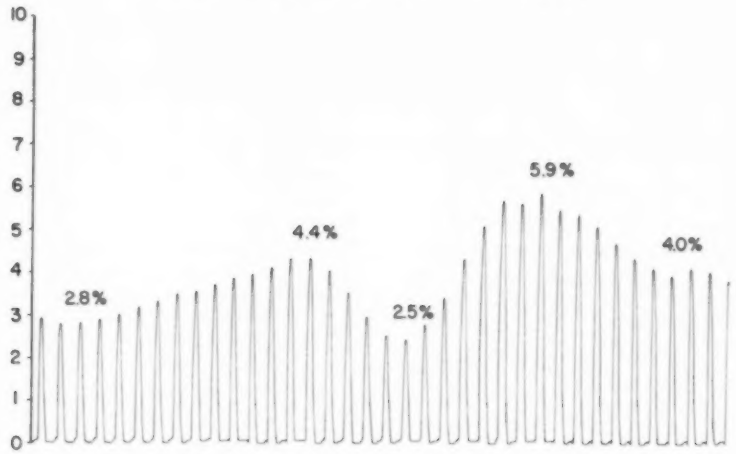

FIG. 3A. Peak heights represent percent isobutane in deisobutanizer bottoms.

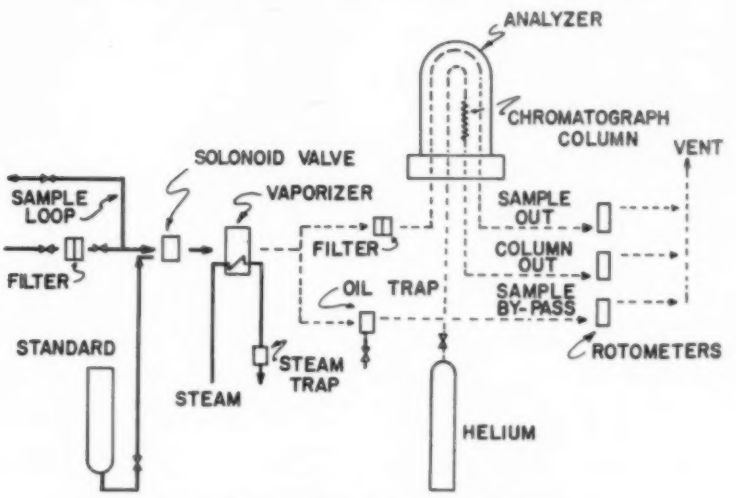

FIG. 4. Chromatograph analyzer auxiliaries.

in Fig. 2. The curve is based on the cost of normal butane as a diluent in the alkylation reaction and the revenue loss when isobutane is used for pressuring motor gasoline. The peak of the curve is between three and four percent isobutane in the bottoms product. Below this percentage, too much normal butane is being forced out the top of the column and the alkylation reaction suffers. Above this amount, too much isobutane (four to ten percent) is being taken out in the bottoms with a resultant loss in pressuring gasoline.

Laboratory analyses were run to check the percentage of bottoms composition that fell in the desired range. Only 28 percent of the analyses showed the product to be in the desired range of composition. The process engineers at Magnolia realized that if the bottoms product could be analyzed every 10 to 15 minutes, the tower controls could be adjusted to maintain the desired split, and a higher yield of the desired products would be realized.

Chromatograph Installation and Operation

A vapor phase chromatograph (Consolidated Electrodynamics Corporation's Type 26-202 Process Chromatograph) was installed.

The unit consists of three parts—analyzer, control unit, and recorder—as illustrated in Fig. 3. The analyzer is located at the base of the deisobutanizer tower. The recorder and control unit are located on the unit panel board.

The analyzer contains a sample introduction system, chromatograph column, and detector unit. The control unit contains power input and distribution systems, master timer, and attenuation switches. The receiver is a standard 10-millivolt one-second response potentiometric strip chart recorder.

Every 15 minutes the time actuates the solenoid valve to introduce a sample to the carrier gas stream which flows through the chromatograph column (¼ in. stainless steel tubing packed with Dow Corning 200-500 on crushed C-22 firebrick). As the sample emerges from the column, its components are separated, generally from light to heavy. A detector bridge circuit measures the difference between the thermal conductivity of each component and the carrier gas. The bridge output signal is attenuated and sent to the recorder. The recorder is energized by the timer cam to record only the peak height of the component(s) desired. Thus, pertinent information is consolidated on the smallest graph possible, as shown in Fig. 3A.

The required analyzer auxiliaries are illustrated in Fig. 4. A slip stream of the tower bottoms is filtered to catch the fine coke and dirt coming from the tower. A standard sample is located near the analyzer to standardize the chromatograph periodically. Either of these liquid streams may be introduced to the analyzer by actuating the solenoid valve from the unit control room. During the automatic operation of the

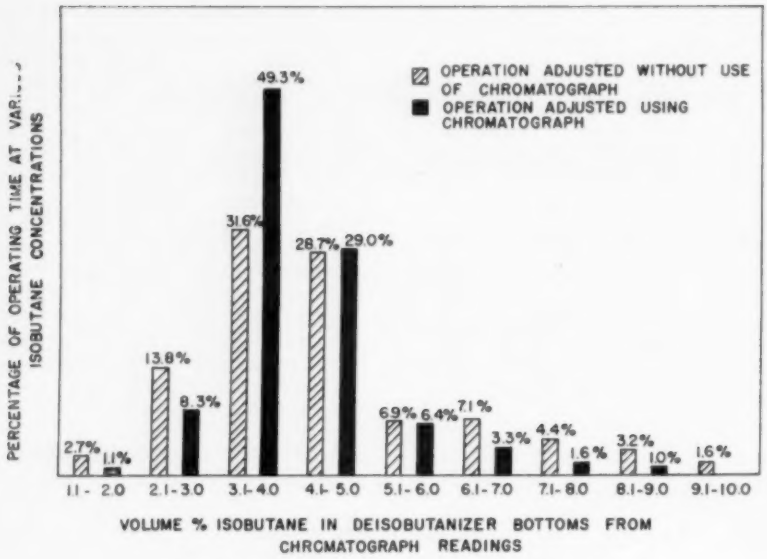

FIG. 5. Chromatograph analyses of tower bottoms.

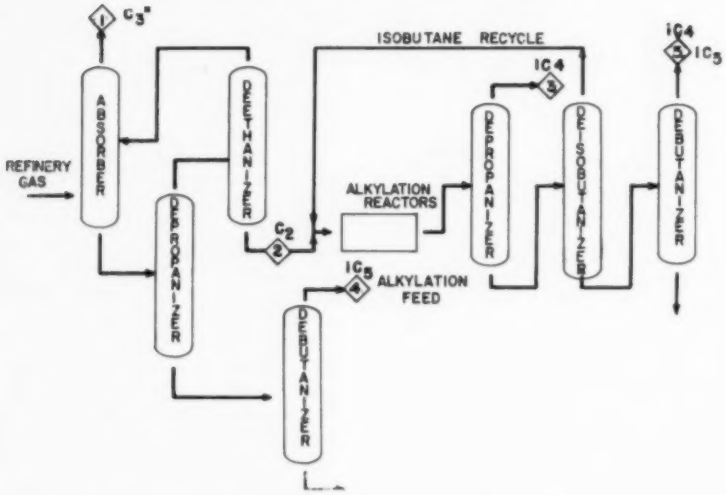

FIG. 6. Typical chromatograph application to process control.

chromatograph, the solenoid valve is set to allow flow of the tower bottoms to the system.

A stream-heated vaporizer evaporates the liquid sample, and the vaporizer effluent is divided into two streams. One stream by-passes the analyzer and goes to vent. The other stream is filtered to protect the chromatograph column, goes through the analyzer sample introduction system, and out to vent. This stream flows at a constant rate of 80 cc per min. Thus, the sample is delivered to the carrier gas stream at constant pressure so the same quantity of material is introduced into the chromatograph column for each sampling. The sample by-pass stream and the liquid sample loop are used to maintain at five minutes the time between sampling and analysis. The tower bottoms contain a trace of heavy components that can cause fouling of the rotameter in the line. These heavy oils will not vaporize at the vaporizer temperature of 250 F, and are trapped out in the sample by-pass loop.

A helium bottle with a pressure reducer is located near the analyzer. The helium flows into the analyzer through the chromatograph column and out to a rotameter. The helium rate is maintained at 80 cc per min so the intervals at which the components emerge from the chromatograph column do not vary. A bottle of helium lasts approximately 80 days.

Maintenance Requirements

The installation requires daily, weekly, and monthly maintenance. The recorder-controller is checked daily for bridge current, bridge output, and zero adjustment. Sample and carrier flow rates are also checked. Weekly maintenance consists of filter renewal and chromatograph calibration. Calibration is accomplished by manual operation of the timer mechanism to obtain a full chromatogram. Moving parts of the analyzer are greased monthly. These procedures are simple and are performed on a routine basis by unit instrument personnel. No extraordinary problems have been encountered so far.

Advantages of Chromatographic Analysis

Analysis by chromatograph is reproducible. The observed variation in analyses for the same sample is $\pm$ 0.1 volume percent. The instrument may be calibrated to give the concentration of a trace component in a mixture. At Magnolia, the chromatograph is set to record the liquid volume percent of isobutane in normal butane. A full analysis is reported as a percentage of the total peak area and is approximately equal to volume percent in the liquid.

Since the chromatograph automatically gives an analysis every 15 minutes, as compared with the five hours for laboratory analysis, tower adjustments can be made more often for changes in product composition.

Definite improvement in tower operation has been achieved since the chromatograph installation. In Fig. 5, chromatograph analyses are grouped in a percentage range according to their compositions. The crosshatched bars represent data obtained shortly after the chromatograph was installed. During this time, the operators were controlling the tower by temperature, as before. This data shows that the bottoms composition was in the optimum control range, three to five percent isobutane in normal, 60 percent of the time.

Data represented by the solid bars was obtained after the tower was run by chromatograph reading. Seventy-eight percent of the samples fell into the three to five percent range. Notice that the solid bars have approximately the same spread as the crosshatched bars. We began to wonder why the tower couldn't be operated to narrow this distribution and maintain the optimum tower split more than 90 percent of the time. A check on the tower control system gave the answer. Tower temperature and pressure varied enough to change the chromatograph indication, but not enough to demand attention when the tower was sampled and controlled through laboratory analyses. Because of this, a sensitive,

FIG. 7. These four process chromatographs analyze seven streams. Switching is manual.

About the authors . . .

L. J. McGovern

L. J. Carlisle

L. J. McGovern *is a supervisory process engineer at Magnolia Petroleum Company's Beaumont, Texas, refinery. He joined Magnolia immediately after graduating from Kansas State College in June 1948, with a BSChE. Until 1954, he was engaged in technical supervision of refinery processing of lubricating oil, waxes, and catalytic cracking. Since that time, McGovern has been responsible for supervisory process design and control of LPG fractionating facilities, light hydrocarbon recovery, and alkylation facilities.*

L. J. Carlisle, *a junior process engineer at Beaumont, graduated from University of Alabama in 1957, with a degree in chemical engineering. He joined Magnolia in June 1957, and has been engaged in light hydrocarbon recovery and processing activities since that time.*

more elaborate control system has been recommended for the tower. Once this system is installed and functioning properly, the tower performance is expected to be much better than that represented by the solid bars.

Additional Installations

By last fall, five chromatographs in addition to the one described here were installed at Magnolia. These instruments range from single stream analyzers to automatically programmed six-stream units. A typical processing scheme utilizing the chromatograph is shown in Fig. 6. Fig. 7 shows installation of a battery of individual chromatographs. Seven sample streams are manifolded into the four chromatographs. Switching to the desired stream is done manually.

Multi-point Alkylation Unit Control

The processing scheme in Fig. 6 is typical for an alkylation unit and its feed preparation system. At Point 1, the propylene content of the absorber off-gas is monitored. This is the key component in the recovery of hydrocarbons from the fuel gas for alkylation feed. At Point 2, the ethane content of a propane-propylene stream is monitored. The ethane must be held to three volume percent of the propane in this stream so the propane, when recovered from the alkylation unit proper, will meet a 95 percent purity specification. Point 3 is the same propane stream. In this case, the other end of the cut, isobutane, is monitored. The isobutane content must be controlled for less than two volume percent so the propane product will meet the two percent residue test for NGAA propane.

Point 4 is a butylene stream which is being prepared for alkylation on another unit. Experience with this unit has shown that hexanes and heavier materials in the feed greatly increase the acid consumption. By maintaining this feed stream at five or less volume percent isopentane, the quantity of heavier material is controlled.

Point 5 is the overhead product from the alkylation debutanizer. This stream must meet 95 percent purity specifications and the two percent NGAA residue test for butanes. Both isobutane and isopentane are monitored on this stream.

LPG Units Fractionator Control

In addition to the examples shown here for Magnolia's alkylation process, several other chromatographs are being installed in the LPG fractionating system to monitor the same type impurities in butane and propane streams. Another automatically programmed two-stream analyzer will be installed in the near future on LPG fractionating facilities. Another application being considered is the analysis of isobutane and normal butane in stabilized gasoline. Two chromatograph columns in series will be required for this analysis. The gasoline will be vaporized and flow into the first column where the pentanes and heavier materials will be retained. The butanes will flow on to the second column for separation and detection while the first column is purged with carrier gas. Then, the procedure will be repeated automatically.

Conclusion

At Magnolia, the chromatograph has proved its ability to function satisfactorily as a field installation. It gives accurate, reproducible analysis, and requires only nominal maintenance.

Operating personnel at the unit have accepted the chromatograph as an aid in controlling their equipment. If the analysis given by the chromatograph is out of range, they check for malfunction and the need for resetting the pressure and temperature controllers on the tower.

The entire refinery operation is being surveyed for possible applications of the chromatograph as a control tool to produce quality products at maximum yield.

Although not definitely scheduled, some thought is being given to the use of the chromatograph as a direct controller. Process engineers anticipate that this will be accomplished after extended testing of the chromatograph in the field. Eventually, perhaps, the only laboratory analysis required will be that for the standardization sample at the unit. ★ ★ ★

REFINERY CONSTRUCTION MANUAL

PART 7: Mechanical Engineering and Design

. . . Utilities Systems and Design

. . . Typical Utilities Requirements

Henry Martyn Noel, *New Canaan, Connecticut*

MOST REFINERIES are coming to rely upon electrical power almost exclusively. Further, except in the instance of remote locations, the tendency is toward the use of power purchased from a utility company. Steam use is largely restricted to electrical power generation, to drive large turbines for air or gas compressors, process applications such as distillation and stripping, heating and purging purposes, and for emergency drivers.

A typical electrical layout for a refinery includes two main circuits with transformers reducing 13,000 or more volts down to 2400 v, the latter supplying motors of 100 or more horsepower. Another transformer circuit will supply 440 v power for motors rated at less than 100 hp. Usual practice is to step down 460-v power to 110/220 v for

TABLE 1. Power Distribution for Hypothetical 25,000 BPD Refinery.

	Installed Capacity, KVA	Average Load, KVA
Pipestill, 25,000 BPD	750	450
Fluid Cat Cracker, 15,000 BPD	3000	2800
Light Ends Plant	250	150
Treating and Sweetening	200	150
Polymerization	100	50
Transfer and Shipping Pumps	2000	500
Water Supply	1500	1000
Shops	400	150
Lighting	500	250
Air Compressors and Misc.	1500	500
	10200	6000

TABLE 2. Process Unit Utilities Requirements per Bbl of Feed, Exclusive of Cycle Stock.

(Assumes centrifugal pumps driven by turbines or electric motors; large compressors and blowers driven by electrical motors or condensing steam turbines; cooling water supplied at 75 F and discharged at 110 F; average thermal efficiency of heaters 70; atmospheric temperature averaging 65 F)

	Steam, lb/bbl(1)			Power, KWH/bbl(1)			Water,	Fuel
	Max	Avg	Min	Max	Avg	Min	gal/bbl	MMBtu/bb
Single-stage Crude Pipestill	1	8	34	0.6	0.3	0.04	200	0.1
Two-stage Crude Pipestill	2	15	50	0.6	0.4	0.06	250	0.1
Atmospheric Rerun Pipestill	—	10	—	—	0.2	—	250	0.1
Vacuum Rerun Pipestill	—	20	—	—	0.0	—	500	0.1
Stabilization Unit	—	40	—	—	0.3	—	200	0.0
Absorber, Splitter, Debutanizer(2)	—	7	—	—	1.1	—	900	0.3
Thermal Reformer	2	70	137	2.1	1.0	0.13	400	0.3
Thermal Cracker	—	5	—	—	7.0	—	1000	0.6
Visbreaker	2	15	28	0.5	0.3	0.03	1000	0.4
Platformer	—	40	—	—	0.8	—	800	0.4
Fluid Cat Cracker	20	110	122	1.7	0.4	0.05	1200	0.0
Thermofor Cat Cracker	—	60	—	—	0.6	—	2800	0.0
Non-Selective Polymerization	57	100	210	3.0	1.0	0.54	500	0.0
Sulfuric Acid Alkylation	480	800	870	4.4	0.1	0.03	6000	0.2
Butane Isomerization	81	90	108	0.5	0.5	0.05	400	0.0
Girbotol (per Mcf)	—	5	—	—	0.0	—	16	0.0
Continuous Acid Treater	—	10	—	—	0.0	—	20	0.0
Caustic and Water Washer	—	0	—	—	0.0	—	10	0.0
Bauxite Desulfurizer	—	5	—	—	0.5	—	250	0.1
Phenol Treater	—	60	—	—	1.0	—	1200	0.5
Clay Contactor	—	40	—	—	0.8	—	800	0.1
Propane Dewaxer	—	250	—	—	4.0	—	3500	0.2
MEK Dewaxer	—	922	—	—	9.2	—	4150	—
Propane Deasphalter	—	200	—	—	0.0	—	2200	0.1
SO_2 Extractor	—	60	—	—	0.5	—	600	0.1
Doctor Sweetener	—	5	—	—	0.1	—	10	0.0
Linde Copper Chloride Plant	—	10	—	—	0.1	—	50	0.0
Hypochlorite Sweetener	—	1	—	—	0.1	—	10	0.0
Sodasol Sweetener	—	20	—	—	0.1	—	100	0.0
Unisol Sweetener	—	30	—	—	0.0	—	200	0.0
Chemico Acid Concentrator(3)	—	5500	—	—	0.0	—	30000	0.0

(1) Steam and power requirements for maximum, average, and minimum use of electric motors.

(2) Per bbl of naphtha plus 2000 cu ft per bbl of compressed gas.

(3) Per ton of 100 percent sulfuric acid.

TABLE 3. Utilities Requirements for a 30,000 BPD Refinery. (Based on unit consumptions in Table 2)

	Unit Capacity, BPD	Steam, M lb(1) Max	Steam, M lb(1) Min	Power, M KWH(1) Max	Power, M KWH(1) Min	Water, M gals	Fuel, MMBtu
Process							
Two-stage Pipestill	30,000	60	1,500	24.0	1.8	7,500	3,000
Platformer	3,000	—	—	15.0	1.5	1,200	900
Cat Cracker	12,000	240	1,440	20.4	0.6	14,400	—
Stabilizer	3,000	120	120	0.9	0.9	600	—
Absorber-Splitter-Debutanizer	1,000	7	7	1.1	1.1	900	300
Non-selective Polymerization	1,000	60	210	3.0	0.5	500	—
Sulfuric Acid Alkylation	1,000	480	870	4.4	0.1	6,000	200
Butane Isomerization	500	40	54	0.3	0.0	200	—
Girbotol Unit (Mcf/day)	500	5	5	0.1	0.1	10	—
Hypochlorite Sweetener	6,000	6	6	0.6	0.6	60	—
Phenol Treater	3,000	180	180	1.5	1.5	3,600	1,500
Propane Dewaxer	1,000	300	300	1.1	1.1	3,500	200
Clay Contactor	500	18	18	0.4	0.4	250	100
Total Process	—	1,516	4,710	72.8	10.2	38,700	6,100
Non-Process							
Oil Pumphouses	—	0	1,400	20.0	0.0	—	—
Water Pumphouse	—	0	700	10.0	0.0	—	—
Lighting	—	0	0	20.0	20.0	—	—
Heating (2)	—	1,000	1,000	0.0	0.0	—	—
Steaming Out	—	100	100	0.0	0.0	—	—
Compressed Air	—	0	0	5.0	5.0	—	—
Personnel Water	—	0	100	1.0	0.0	200	—
Mechanical Shops	—	0	0	10.0	10.0	—	—
Boiler House	—	0	0	0.0	0.0	200	2,000
Power House(3)	—	1,500	800	0.0	0.0	—	—
Miscellaneous	—	50	150	15.0	5.0	—	—
Total Non-process	—	2,650	4,250	81.0	40.0	400	2,000
Grand Total	—	4,166	8,960	153.8	50.2	39,100	8,200

(1) Maximum and minimum use of electric motors.
(2) Average for year, cold climate.
(3) Condensing versus back pressure.

lighting and other purposes at various distribution points around the plant.

Twin circuits are usually provided, equipped with secondary selector systems, so that one will take over in the event of failure in the other branch of the circuit.

Typical Power Requirements for Process Units

Equipment for a 60,000 bbl per day three-stage pipestill would include about 12 large motors (100 to 450 hp) on the 2400-v circuit and about 30 motors in the three to 100 hp range on the 440-v line. About a third of these motors would be spares.

Electric equipment for this 60,000 bbl per day still would cost about $250,000, total. The motors would cost about $70,000, switchgear would cost about $70,000, and about $35,000 would be spent for transformers. Wiring, conduits and various fixtures would cost about $90,000.

Catalytic crackers are large power consumers since the centrifugal blowers alone require 1500 to 6000 hp for average to large units. Tidewater Oil Company's 102,000 bbl per day fluid unit at Delaware City has an 11,250 hp driver . . . a steam turbine, however. The gas compressors for a cat cracker nominally consume about two-thirds as much power as the air compressors. Cat reformers also consume large amounts of power, principally for compression of hydrogen-rich recycle gas. A simple one-stage pipestill may operate with only a dozen motors and relatively low power consumption.

Typical power requirements for a hypothetical 25,000 bbl per day refinery are shown in Table 1. Examples of power requirements for various processes are given in Table 2, and Table 3 provides utility requirements for a complete 30,000 bbl per day refinery, using the values from Table 2.

Water Supply System

An ordinary refinery requires as much water as a large city. The problems of pump, settling basin, purification, and layout design are of major importance.

Table 2 includes typical water needs for selected process units, based on water into the system at 75 F and exiting at 110 F. These figures are readily corrected for other temperature conditions.

After establishing maximum cooling water requirements, the mechanical designers specify line and pump sizes and duties. Economical pipe sizes can be derived from standard tables once flow requirements for main lines, laterals, etc. are known.

The main supply line for a refinery using 100,000,000 gal per day of cooling water would be about 60 in. diameter, while a 20,000,000 gal per day flow would require a main about 36 in. diameter. Power needs are minimized by limiting main pump discharge pressure to about 100 psig, using boosters where required.

Sewer facilities are designed to meet the capacity of the cooling water system, less the volume of water recirculated. A separate system is usually provided to handle rain or snow storm run-off.

Effluent water, both from cooling units and storm run-off drains, must be cleaned up before discharging into public waters. Settling basins and separators are provided to permit neutralization of chemicals and removal of oil. Bio-oxidation units . . . "bug" plants . . . are frequently used where the water is contaminated with phenolic compounds.

Separator and settling basin design is well standardized, and set forth in the American Petroleum Institute's Waste Disposal Manual. The separator for a small refinery would be about a 100 ft wide, 6 ft deep, and about 300 ft long.

Water for sanitary and drinking purposes is usually a simple problem handled in connection with the design of offices or employee housing or, perhaps, in conjunction with the facilities installed for boiler feedwater purification.

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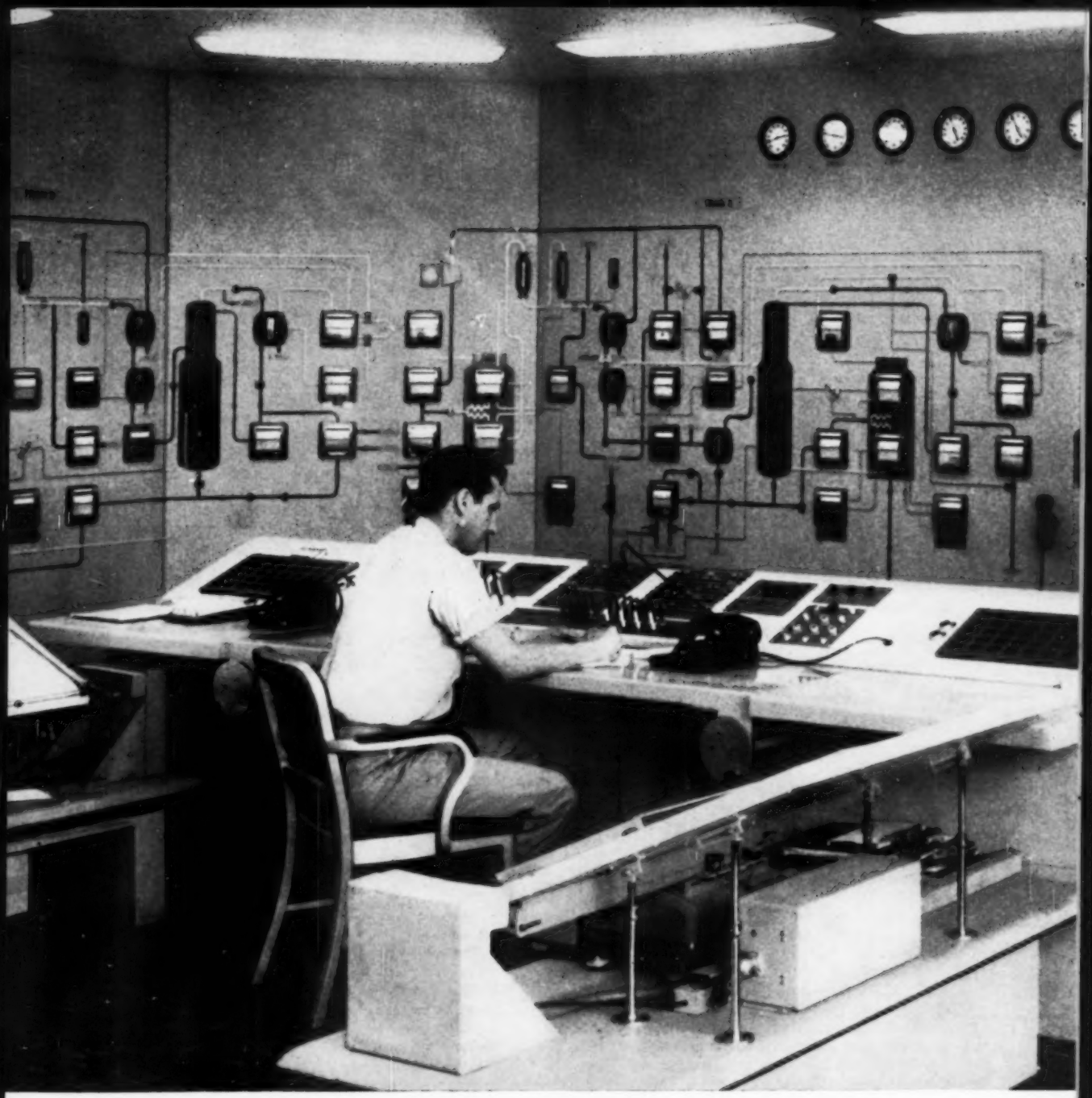

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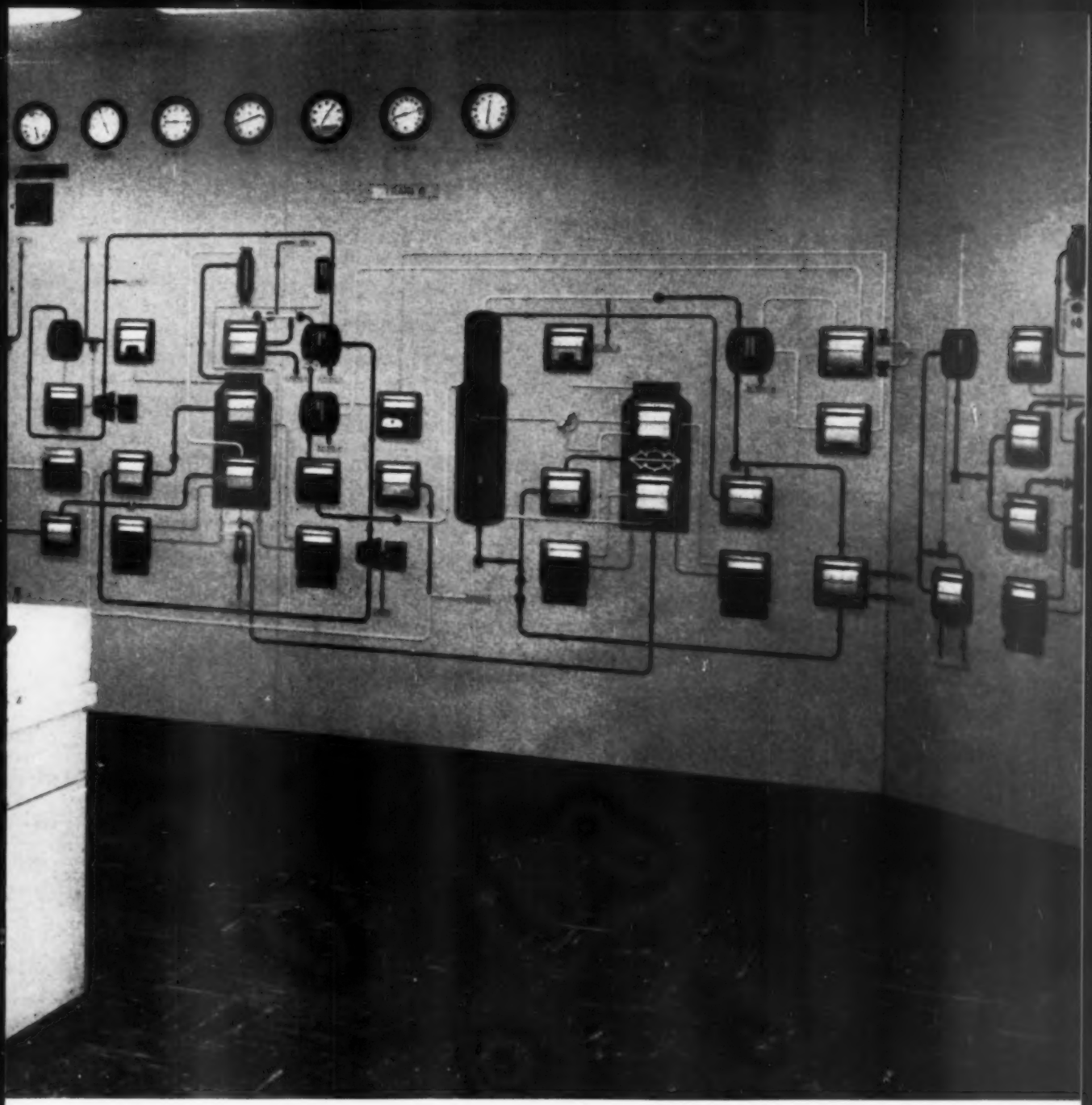

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tures especially helpful when "tuning" controllers to a new process.

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SHOWN ABOVE: Graphic control panel for catalytic desulfurizer unit, Tidewater Delaware Refinery. Over 400 Foxboro Consotrol Instruments are used in this ultramodern refinery.

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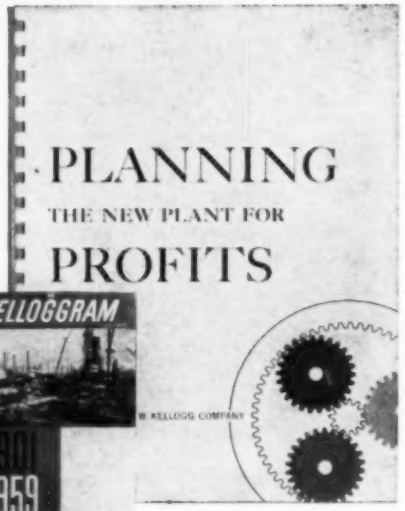

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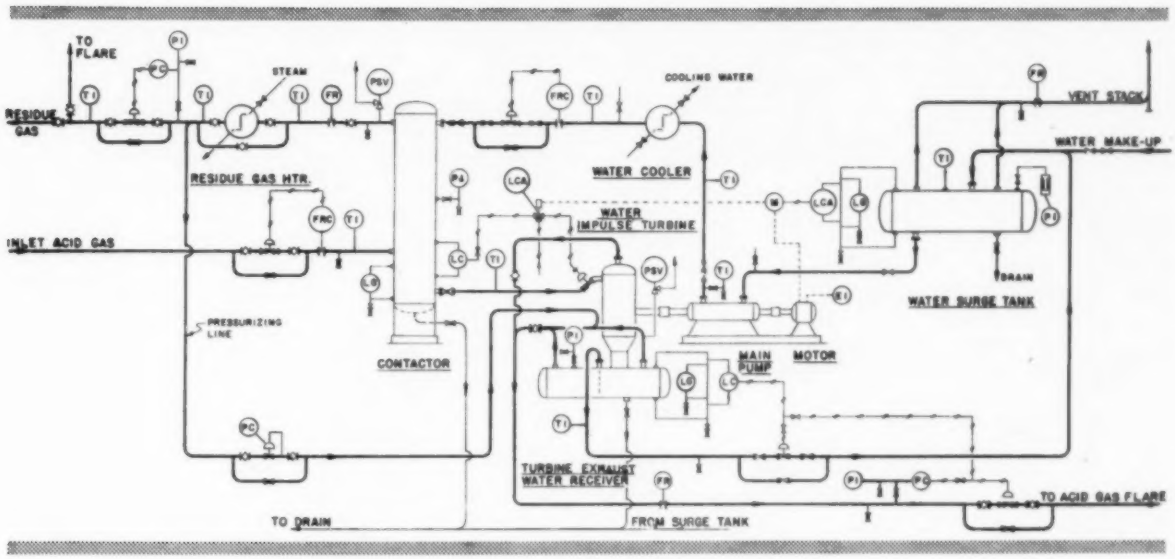

FIG. 1. Aquasorption pilot plant flow diagram.

A new look at an old process . . .

Water Washing for Acid Gas Removal

Recent installations and studies have shown "Aquasorption" to be a practical process for gas sweetening, particularly with high H_2S to CO_2 ratio. Here's a complete design and economics report

J. G. Burnham, *Stearns-Roger Mfg. Company, Denver, Colorado*

THE DIFFICULTIES OF SWEETENING GAS have been with the oil and gas industry for a long time, and there appears to be little chance of their diminishing. In recent years the concentrations in sour gases have generally increased and 20 to 30 percent or more CO_2 or 20 to 30 percent H_2S in raw gas is not uncommon. Our neighbor to the North, Canada, seems unable to discover a field without a high level of H_2S. Thus, the question of how to treat high acid gas concentrations economically is apt to become more acute with time.

Problems associated with other processes prompted the suggestion that an old process — water wash — be revived. Due to association and habit, it is difficult not to refer to this water washing system in any way other than "Aquasorption." It was emphasized in the suggestion that Aquasorption had been used years ago in the chemical industry, was still being used to some degree in ammonia synthesis, and had been in operation at Louisiana, Missouri, by the Bureau of Mines in experimental hydrocarbon synthesis from coal.

Process Development and Design

All chemical industry applications had been at relatively low pressures, whereas a practical adaptation to natural gas had to be at much higher pressures.

From here, the attack was the same as is normally employed in such circumstances — a mixture of desk and research work. Tests were conducted for determination of equilibrium data at different temperatures and pressures, using actual field gas compositions. Small scale equipment was assembled and other tests made to help solve problems of efficiently contacting gas with large volumes of water. Research information was then applied to design a unit to treat principally a high CO_2 to H_2S ratio gas.

Fig. 1 shows the process system that was designed. The essential parts of the system are labeled and are: The contactor, the water impulse turbine, the main water pump with an extended shaft to take an electric motor or other additional power source on the outboard end of the pump and the water surge or flash tank. The pump discharge stream is cooled to remove the heat input due to pump inefficiency. The horizontal tank under the water wheel is for the purpose of taking water from the wheel as quickly as possible, and was planned for operation at 15 psig. The flash or surge tank was to be elevated for essentially atmospheric operation.

Investment Requirements

Using this design, comparisons of investment with stand-

*Adapted from a paper presented by the author to the 33rd Annual Meeting of the California Natural Gasoline Association, Pasadena, California, October 1958.

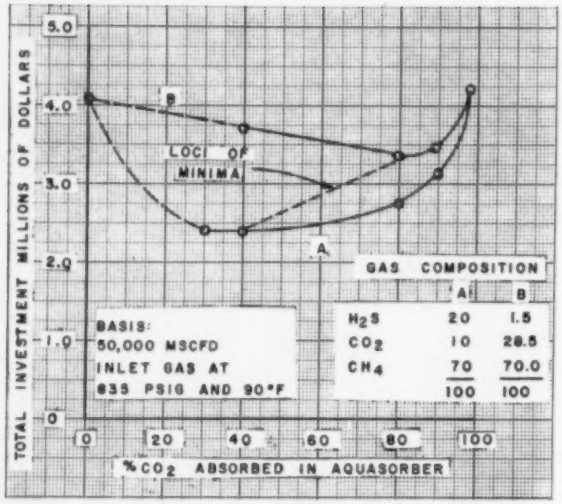

FIG. 2. Investment vs $\%CO_2$ absorbed with different H_2S/CO_2 ratios.

ard treating processes were prepared. Indications were that further study of the process was needed and that the system held great promise of a low fuel demand and a resulting larger percentage volume of gas for sale.

Fig. 2 shows investments obtained at that time using H_2S and CO_2 ratios of rather wide range. The curves obviously show what was suspected: That Aquasorption is a more favorable process for high H_2S to CO_2 compositions, and for either ratio the investment is somewhat less than for a conventional plant. The dotted line represents the optimum percent absorption in terms of CO_2 necessary to obtain the minimum investment. The cost figures are for the total operation of Aquasorption plus follow-up extraction where it is required to meet sales specifications.

Commercial Installation

The data shown in Fig. 2, and other supplemental material, was sufficient to interest a major company in the construction of an operating unit. The capacity was determined as large enough to test practical or commercial equipment, and yet maintain sensible utility demands for power, water, etc. The unit was constructed for 1,000,000 cu ft per day of inlet gas containing 15 percent CO_2, 1 percent H_2S with the balance essentially hydrocarbons. The contactor was designed for 825 psig; all other equipment was about as shown in Fig. 1.

Few reports ever portray the widgets and bugs that bedevil an operation of this type and there were some. Nevertheless, in time good data were obtained, and the unit operated about 30 percent above the design capacity.

Fig. 3 sets forth only a part of the key bits of information that were sought, namely, how much absorption could be obtained. The curve shows the percent of CO_2 absorbed against increasing L/V ratios based on approximately eight hours of continuous, steady operation. The system reacted rather quickly to changes in either gas or water volume. Since equilibrium could be obtained rapidly, operating data could also be collected quickly.

From intermittent operation of this unit over several months, reliable information was collected, proving that the equilibrium data could be trusted, that the tower efficiency could be predicted, and that the equipment had been practically selected. No unreasonable difficulties in operation of the water wheel, the pump or driver were encountered. In fact, the power recovery scheme worked so well that a similar application was installed in a plant in a Western province of Canada for the recovery of about 700 hp in a plant circulating 30,000 gal per min of water.

Design for Higher Concentrations

About this time it would have been well for the plant to have been portable or to have called on the genie of Aladdin to transport the unit to other geographical areas in order that further testing might continue in fields having gases with the high H_2S to CO_2 concentrations.

From this point, further review of the published literature, some additional research work and a great deal more desk work has had to take the place of another pilot plant. One immediate drawback appeared from study of the pilot plant data and its application to the high H_2S to CO_2 ratio gases. Aquasorption as applied to these concentrations, without any modification, would certainly deliver an acid gas containing more hydrocarbons than a sulfur recovery plant could tolerate.

Another difficulty emerged on the mechanical side, with the problem of pump selection for the circulation of large quantities of water, say, 8000 to 10,000 gal per min and upward, for contact with the high CO_2 and H_2S gases. For this service manufacturers of pumps will quote NPSH demands in the neighborhood of 100 ft, which is normally an impractical requirement to meet.

Another difficulty popped up, too — selection of the water pump driver. If, for example, 800 to 10,000 gal per min or more of water were required and a high CO_2 content was to be processed, then the logical drive might be a gas-fired turbine. However, an extremely low heating value gas would be produced from the turbine receiver tank. There is at least one make of gas fired turbine available commercially and there are perhaps others capable of operating on a low Btu gas. Even then, this fuel must be preheated and some supplemental firing with high Btu gas may be necessary to obtain satisfactory operation.

Water Wheel Design

Design difficulties due to high amounts of hydrocarbons

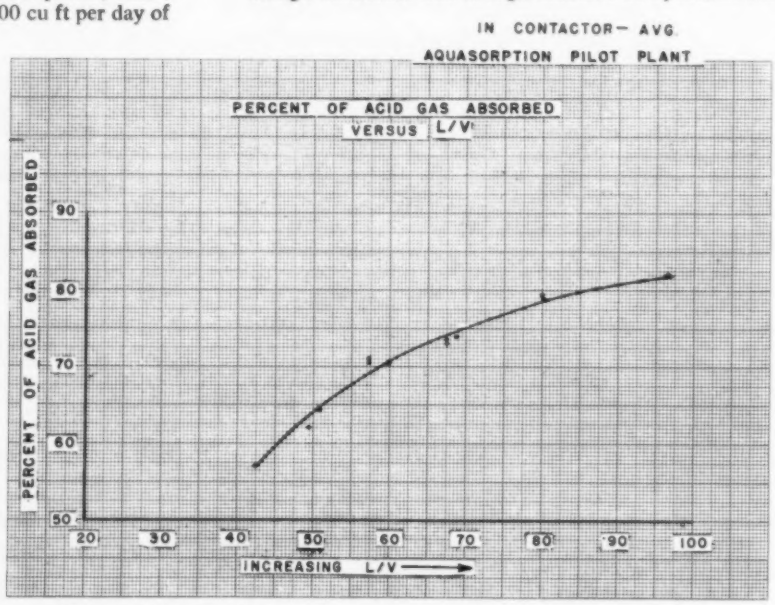

FIG. 3. Acid gas absorbed vs L/V in contactor — average Aquasorption pilot plant.

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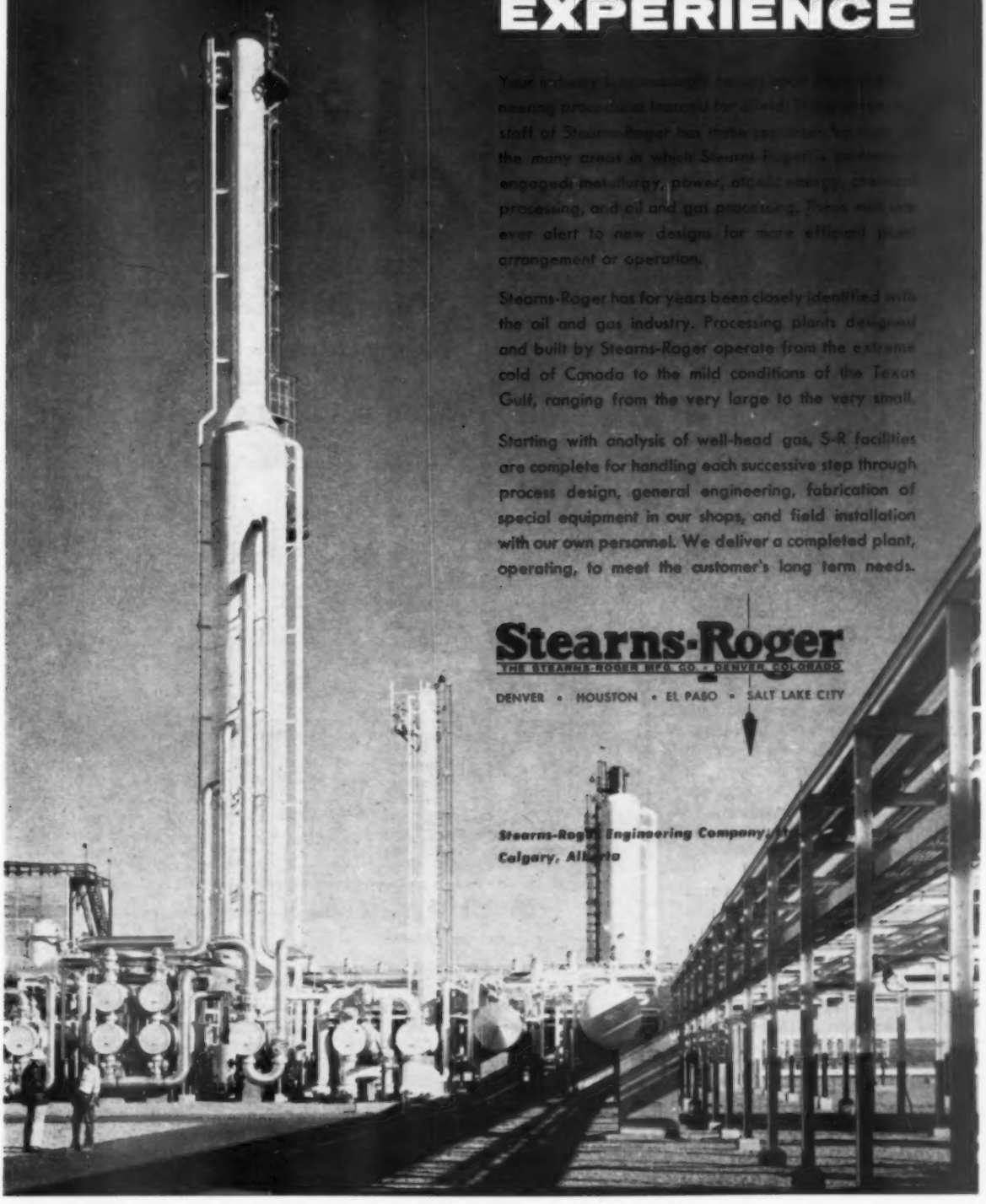

Your industry is [illegible] your [illegible] engineering procedures learned for a wide [illegible] staff of Stearns-Roger has [illegible] the many areas in which Stearns-Roger is [illegible] engaged: metallurgy, power, atomic energy, chemical processing, and oil and gas processing. [illegible] ever alert to new designs for more efficient plant arrangement or operation.

Stearns-Roger has for years been closely identified with the oil and gas industry. Processing plants designed and built by Stearns-Roger operate from the extreme cold of Canada to the mild conditions of the Texas Gulf, ranging from the very large to the very small.

Starting with analysis of well-head gas, S-R facilities are complete for handling each successive step through process design, general engineering, fabrication of special equipment in our shops, and field installation with our own personnel. We deliver a completed plant, operating, to meet the customer's long term needs.

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in the sulfur plant feed, high NPSH for the water pumps, and low Btu fuel gas may not appear related, however, they proved to be. All the previous planning for the initial design, for the pilot plant, and for the installation in Canada had been concerned only with impulse type water wheels, which required a low back pressure and a drop-out drum to take the water from the wheel quickly. Investigations showed that reaction type wheels which would operate satisfactorily with high back pressure are commercially available in the sizes required. The reaction type, sometimes known as the Francis wheel, will operate at rotating speeds in the range of 1800 to 2500 rpm, eliminating the speed increases previously required between the turbine and the pump.

Stage Flashing

With the use of the reaction type wheel, stage flashing of the rich water can be used effectively and for manifold purposes. A stage flash pressure can be selected to produce a specified volume of gas having a reasonable heating value, which is then suitable fuel for any power source. By judicious selection of the flash pressures an economical fuel balance may be obtained, not only for the Aquasorption but for the clean-up unit as well.

The energy derived from the stage flashing can operate a booster pump on the lean water stream, and reduce the NPSH requirement of the main pump to practical limits. Also stage flashing will meet the problem of hydrocarbons in the feed to a sulfur plant.

With the introduction of stage flashing the process is modified as shown in Fig. 4. The flow sheet sets forth only one intermediate stage of flashing, which is all that should be required for most applications. The stream from the flash tank will contain considerable H_2S when a high H_2S to CO_2 ratio gas is treated, and will generally need additional processing before being used as a fuel source. For each of the flow sheets that have been shown, the surge tank is to operate at substantially atmospheric pressure. If the acid gas is transported to a sulfur recovery unit the surge tank will have to operate at four to five pounds above atmospheric pressure. When the acid gas has no valve, the tank can be operated as low as possible.

Table 1 depicts the effect of the stage flashing as a function of gas composition. The effect of water circulation rates at constant temperature has also been introduced. Case I represents about the average H_2S to CO_2 ratio that might be encountered, say, in Western Canada, and Case II would be approaching the maximum acid gas ratio for the same area.

A number of conclusions can be drawn from this tabulation. Primarily it shows that the efficiency of acid gas removal is far better for the high H_2S content gas. Further, the varied flash pressures show the latitude of the volumes available for fuel and the flexibility in composition and heating value. The percent of hydrocarbons in the acid gas stream is expressed as percent of the combustible material, which excludes the carbon dioxide.

Different flash pressures, shown for the two cases, illustrate the range and the effect of the pressure variance.

Hasty inspection of the acid gas concentrations in the outlet gas might lead to the conclusion that the performance is below expectation, however, Aquasorption alone cannot do the full clean-up of acid gases. But, where applicable, it can reduce the overall investment appreciably and tremendously lower the operating cost.

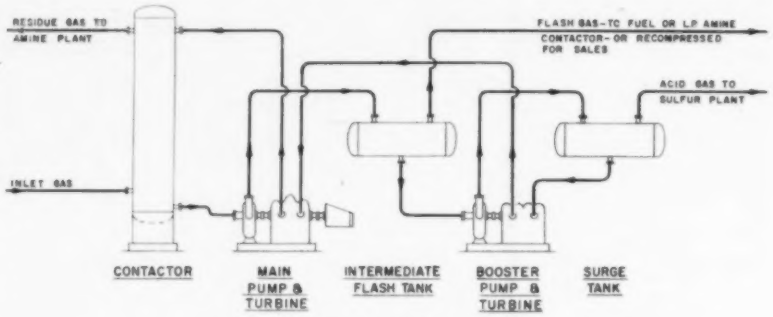

RESIDUE GAS TO AMINE PLANT
FLASH GAS-TO FUEL OR LP AMINE CONTACTOR-OR RECOMPRESSED FOR SALES
ACID GAS TO SULFUR PLANT
INLET GAS
CONTACTOR
MAIN PUMP & TURBINE
INTERMEDIATE FLASH TANK
BOOSTER PUMP & TURBINE
SURGE TANK

FIG. 4. Aquasorption with stage flashing.

TABLE 1. Stage Flashing with Different Acid Gas Concentrations.

GAS COMPOSITION - MOL %	CASE I				CASE II			
H_2S	15.02				33.94			
CO_2	2.02				10.95			
METHANE PLUS	82.94				55.11			
TOTAL	100.00				100.00			
GAS VOLUME / CONTACTOR PRESSURE	50 MMSCFD 900 PSIA				50 MMSCFD 900 PSIA			
WATER CIRCULATION	2000 GPM		2500 GPM		2500 GPM		3000 GPM	
% H_2S IN OUTLET	6.00		4.00		7.00		4.00	
% CO_2 IN OUTLET	1.98		1.96		13.34		13.31	
FLASH PRESSURE - PSIA	200	300	200	300	600	500	600	500
FLASH VOLUME - MSCFD	2176	1571	2608	1935	1407	2224	1430	2231
MOLS/D H_2S IN FLASH VOLUME	3140	1784	3646	2096	1844	3389	1703	3108
% HYDROCARBON IN ACID GAS	1.64	2.94	1.79	3.14	2.05	1.28	2.51	1.62

TABLE 2. Comparison of Aquasorption with Amine Treating.

	CASE I		CASE II	
	AQUASORPTION PLUS AMINE TRIM	AMINE ONLY	AQUASORPTION PLUS AMINE TRIM	AMINE ONLY
INVESTMENT	$2,894,000	$3,350,000	$3,950,000	$6,779,000
FUEL GAS COST $/YR.	$ 43,000	$ 91,000	$ 76,000	$ 240,000

DU PONT Petroleum Chemicals NEWS

Number 94 in a Series of Bulletins for the Petroleum Industry

JANUARY-FEBRUARY 1959

New Du Pont RP-2 adds 3-way salespower to gasolines

Now refiners and marketers can improve their gasolines with "Du Pont RP-2," another product of Du Pont research to improve performance of petroleum products.

HOW RP-2 CAN SELL FOR YOU: Sample advertising kit, prepared by Du Pont's Advertising Department, shows how the use of RP-2 can be advertised and create new excitement for your brand of gasoline.

RP-2 adds three distinct kinds of improvement to gasolines:

Prevents Rust. RP-2 "plates out" on metals, forming a barrier between the metal and any moisture that may be present in the gasoline. Thus rusting is prevented throughout the automobile fuel systems from gas tank to carburetor. Incidentally, RP-2 also offers the same protection at the refinery and in the fuel distribution system.

Stops Carburetor Icing. RP-2 prevents stalling during idling caused by ice formation on the carburetor throttle plate. Many gasolines need this protection when the temperature ranges from 22 to 55°F. and relative humidity exceeds 65%.

Provides Detergent Action. RP-2 has a positive detergent action which not only keeps new carburetors clean but gradually cleans the throttle plate and throat of carburetors which have become dirty through long use.

The above advantages add up to improved performance on the highway and better satisfied gasoline customers. As mentioned above, there are also economy advantages for the refiner in the rust-preventive characteristics of the additive in protecting storage and shipping equipment.

Another important property of RP-2 is that it contains phosphorus. This makes it especially attractive to refiners already using phosphorus compounds for control of surface ignition. Thus, by taking a "phosphorus credit" the cost of protection against rust, carburetor icing and carburetor deposits is appreciably reduced.

While it has been widely adopted for use in motor gasolines, RP-2 is also an excellent rust preventive for aviation gasoline. And it is particularly interesting for jet fuel because, in some cases, rust preventing dosages also improve the CFR fuel coker ratings of the fuel.

Write for technical information.

"It Never Rains Oil" depletion movie still playing to packed houses

The story of petroleum is still "big box office" around the country.

Probably one of the best signs of this is the continued success of "It Never Rains Oil," the full-color cartoon movie that tells the story of oil exploration, consumption and *depletion*.

Year after year, the film plays to capacity audiences of civic organizations, clubs, service station operators, and other groups in which opinion is formed.

It shows how oil is bringing better things into all our lives—from paints to pants, from synthetic rubber to better lubricants.

Explains need

The movie goes on to show the dramatic search for oil—and the tremendous odds that face the searchers – as well as the growing consumption that makes an ever wider search necessary. It explains the government's recognition of the great cost of the search, in the form of a percentage depletion allowance. The film explains why this tax relief is desirable, necessary and fair.

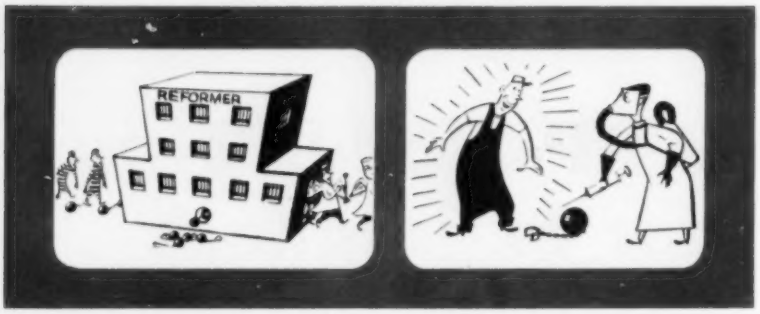
Promotes better understanding

After viewing "It Never Rains Oil," audiences often report that they have a new, more appreciative viewpoint of what the oil industry is accomplishing. They better understand its problems and plans. If you would like to arrange showings, simply write, telling us when you would like to borrow the film and how long you would like to have it.

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

DU PONT *Petroleum Chemicals* NEWS

"Good Gasoline" movie goes before cameras a second time — for a new, modern look



MOVIE SHOWS HOW reforming (left) and addition of TEL (right) turn "bad" hydrocarbon molecules into good ones to prevent knock.

"What Makes Today's Gasoline Good" —the Du Pont sound-and-color movie that's been a hit with refiners and dealers for a number of years—has had its face lifted.

Writers, directors, actors and camera crews have been hard at work for the past several months, bringing it up to date.

The story line has changed, but the primary message remains as it was, a description of how refiners use cat-cracking, reforming, and tetraethyl lead and other additives to give gasoline the right qualities for good engine performance.

It compares "regular" and "premium" grades of gasoline, and uses amusing cartoon characters to explain knock, vapor lock, the reasons for seasonal blends, and other important aspects of gasoline.

The movie is perhaps one of the fastest, most memorable ways of showing and convincing service station operators (and even refinery employees) that much more goes into a gallon of gasoline than the average motorist realizes. Enthusiasm is created, along with improved sales-consciousness, when the picture is shown at dealer meetings.

Showings of the Du Pont movie can be easily arranged through your Du Pont representative, or by writing direct to Wilmington.

YOU OUGHT TO KNOW...

ROBERT M. GLOVER was recently appointed Manager, Sales Programs, in the Petroleum Chemicals Division of the Du Pont Company, a position he assumed after vacating the office of Assistant Sales Manager. There his chief interest was tetraethyl lead sales combined with administrative duties concerned with manpower in the five regions of the division.

Mr. Glover brings to his new position a wealth of experience also in the petroleum additives field, where he has helped Du Pont customers solve a wide variety of blending and marketing problems.

At one time, Mr. Glover served as Manager of the Du Pont Petroleum Chemicals Division's Mid-Continent Region, with headquarters in Tulsa. In that capacity, he served all Du Pont customers in the area with the complete Du Pont line from tetraethyl lead to the most specialized additives.

Winter freeze gets a cold shoulder from pipe that's made from oil

"If winter comes, can the plumber be far behind?" might be the modern version of one of the poet Shelley's famous lines.

It *might*, but the oil industry is changing all that. No longer does the freezin' season mean that pipes must freeze up and be repaired. In industry, the use of "Alathon"* polyethylene resin pipe is eliminating this costly and often dangerous problem.

Pipe of "Alathon" is made of a plastic based on petroleum. Its most remarkable quality is its flexibility. Instead of freezing and bursting, it simply expands. Even at 40° below zero, this pipe can be bent around corners.

Another advantage is its extreme light weight. Its corrosion resistance and its lack of odor and taste are bonus advantages.

"Alathon" polyethylene resin is the same material from which literally millions of squeeze bottles of cosmetics and many other products are made every year.

This is one further example of the growing contributions of *oil* in bringing better living to more people, through chemistry.

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Pittsburgh 22—1 Gateway Center ATlantic 1-2933
San Francisco 4—111 Sutter St. EXbrook 2-1934
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... through Chemistry

Du Pont Tetraethyl Lead and other Petroleum Additives

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

A-8654

Printed in U. S. A.

About the author . . .

J. G. Burnham *is chief engineer for the Oil & Gas Division of The Stearns-Roger Manufacturing Company, Denver, Colorado, and has spent over 13 years in process engineering for them. During his tenure with this company, he has been instrumental in the design and engineering of many gas processing plants including some of the largest installations built to date.*

Previous to joining Stearns-Roger, he was affiliated with the Shell Oil Company in its Mid-Continent Gas and Gasoline Division; with the Joseph A. Coy Company at Tulsa, Oklahoma; and with Parkhill-Wade of Houston and Los Angeles.

Burnham is a registered professional engineer in Colorado and Alberta, Canada. He is also a member of the Canadian Standards Association.

Overall Performance and Cost

Any conclusion concerning the performance ability of the system should be deferred until the investment and fuel cost are reviewed as illustrated on Table 2.

Investment and fuel cost are compared for Aquasorption with the follow-up amine plant versus an amine plant only. A similar comparison may be made of Aquasorption against any other treating system.

The conditions assumed for this comparison are 10 cents per Mcf for fuel cost, steam generation for use with water pump turbine drives and for reboilers in the follow-up plant, and nominal usage of special corrosion resisting materials. These costs are first approximations only. Careful adjustment of the flash pressures for an optimum steam balance would probably result in a still more favorable comparison.

Generally, Aquasorption used for primary extraction can be expected to be about 12 to 15 percent less in investment and require about 50 percent less in fuel costs than an equivalent amine plant for the low ranges of H_2S to CO_2 and in the order of 40 percent less in investment and 70 percent less in fuel respectively for the higher ranges.

Investment and efficiency, as in any other process operation, may be considerably effected by introducing other factors of design or equipment. For instance, should the installation be of sufficient size to justify the use of gas turbines, then perhaps the capacity of the plant could be nearly doubled with less than the normal incremental increase in investment. After reaching a certain size of gas turbine, the next larger size can be purchased for very little additional money.

Also, for some cases processing large gas capacities the combination of the use of the low Btu stream for fuel in a CO boiler may be economically beneficial.

Vacuum flashing of the surge tank may show increased overall extraction efficiency at an investment saving, particularly for processing the higher CO_2 to H_2S ratios.

The process lends itself to compact construction by the use of a stacked structure with pumps, drives, and contactors at grade level, with exchangers, flash tanks and surge tanks at the upper levels. An arrangement such as this requires fewer operating personnel and facilitates housing in colder climates.

Conclusion

In summary, Aquasorption is a practical process for the removal of acid gases, particularly with high H_2S to CO_2 ratio. The greatest advantages are the flexibilities available in design to meet the varying requirements of acid gas removal so as to deliver the maximum cubic feet of gas to sale. * * *

Socony Mobil Unitizes Controls on Engine Test Hookup

Four previously separate operations, employing five single cylinder diesel engines, have been unified at a single location by use of a novel, "building block" control console developed by Socony Mobil Oil Company engineers.

G. B. Myrtetus and A. W. Kees custom designed the console, which is in use at Socony Mobil's Paulsboro, New Jersey, research and development laboratory.

Formerly at four separate locations, the five diesels required individual control equipment and instrumentation, plus separately trained operators, in the function of measuring performance and quality of experimental lubricating products.

With the new modular control, functions of all the engines can be controlled by a single technician.

Kees and Myrtetus selected standard modular enclosures, panels and components, made by Elgin Metalformers Corporation of Elgin, Illinois for the construction of the 20 ft long central control unit.

Then the unit was assembled at Paulsboro, by joining together the standard Emcor enclosures chosen — much in the manner of building blocks.

All equipment and controls are within easy reach and sight of the control operator, with all five engines now controlled by identical equipment to eliminate much of the complexity formerly involved.

Furthermore, technical procedural details which were overlooked occasionally in the former setup are included automatically in the test assignments.

One technician operates the control console developed by Socony Mobil.

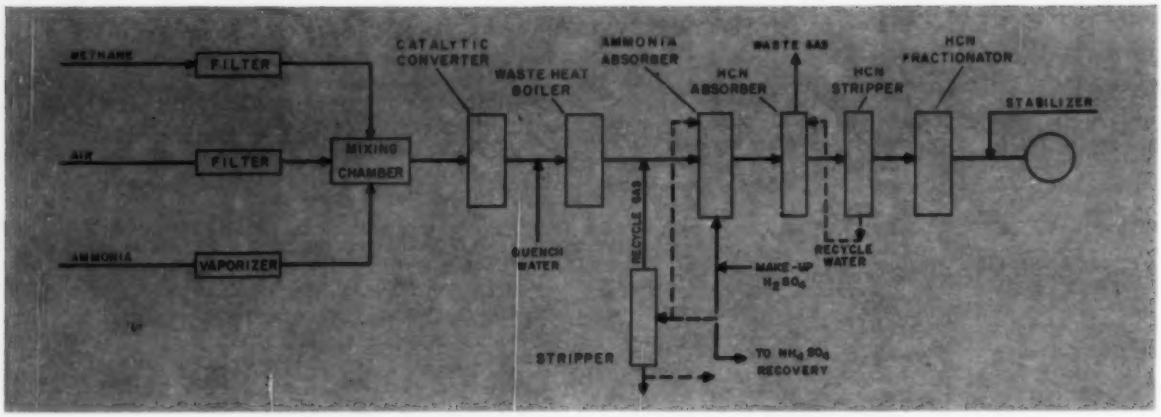

FIG. 1. **Block flow diagram of autothermic HCN synthesis process.**

Second of three parts on a growth petrochemical... HCN

Synthesis of Hydrogen Cyanide By Autothermic Reaction

Peter W. Sherwood,
Chemical Engineer, White Plains, New York

SEVERAL COMMERCIALLY FEASIBLE processes are available for synthesis of hydrogen cyanide. Included are:

- The reaction of ammonia and hydrogen with carbon monoxide,
- Reaction of nitric oxide with a hydrocarbon,
- Dehydration of formamide, and
- The reaction of methane and ammonia, with or without the addition of air.

Only the last two of these approaches are in actual commercial use, so far as is known. In addition, a relatively small amount of HCN is obtained by direct recovery from coke-oven gas.

HCN via methane and ammonia is of foremost importance. This synthesis is carried out autothermically, i.e. in the presence of air, in present-day plants. Commercially promising methods have been developed during the past few years, however, for HCN synthesis from methane and ammonia without addition of air. This method will be discussed in the next part of this series, along with recovery of HCN from reaction gases. Autothermic synthesis will be discussed here.

Chemistry of HCN Synthesis

Formation of hydrogen cyanide from ammonia, methane and oxygen takes place via two routes. One, the endothermic direct reaction between methane and oxygen, takes place via two routes. One of these is the endothermic direct reaction between methane and ammonia:

$$CH_4 + NH_3 + \text{app. } 60 \text{ Kcal} \rightarrow HCN + 3H_2 \quad . \quad . \quad (1)$$

Mechanism of this transformation has not been fully explored, but methyleneimine ($HNCH_2$) is apparently one of the intermediates.

The second main reaction course, which occurs simultaneously, appears to proceed as follows:

$$NH_3 + O_2 \rightarrow NH_3 \cdot O_2 \rightarrow HNO + H_2O \quad . \quad . \quad . \quad (2a)$$

$$HNO + CH_4 \rightarrow HNCH_2 + H_2O \rightarrow HCN + H_2 + H_2O \quad . \quad . \quad . \quad (2b)$$

$$NH_3 + O_2 + CH_4 \rightarrow HCN + H_2 + 2H_2O \quad . \quad . \quad (2)$$

Equation 2 is accompanied by the evolution of 66 Kcal/mole. As one might expect, much . . . but not all . . . of the hydrogen formed in the course of reaction (2) will react with oxygen at operating conditions, so that we get this overall equation:

$$NH_3 + CH_4 + 1.5O_2 \rightarrow HCN + 3H_2O + 144 \text{ Kcal} \quad . \quad . \quad . \quad (3)$$

Of these transformations, reactions (2) and (3) occur at very high rate, even below 850 C. Equation 1, on the other hand, becomes significant only above 1100 C. In practical execution of the autothermic process, the direct reaction assumes a secondary position and the feed composition is selected to meet the demands of Equation 3.

Accompanying these main conversions are several side reactions which lead, albeit in small measure, to carbon monoxide and hydrogen . . . by partial combustion of methane . . . and to elemental nitrogen and water . . . by partial combustion of ammonia.

It is possible to carry out the autothermic production of hydrogen cyanide in a flame; i.e. in the absence of catalyst. This approach will be briefly described in the discussion on reactor design. In commercial practice, however, catalysis is universally employed.

Purpose of the catalyst is to accelerate the main reaction, which predominates in any event, rather than to guide the

course of the reaction. Thus, at 1000 C a residence time of about one second is required in the absence of a catalyst, while the use of platinum catalyst permits essential completion of the conversion . . . Equation 3 . . . 1/10,000 seconds.[21] Favorable reaction velocities in non-catalytic operation would call for a higher temperature (1300 C), attained by using an excess of methane and oxygen, with reference to ammonia.

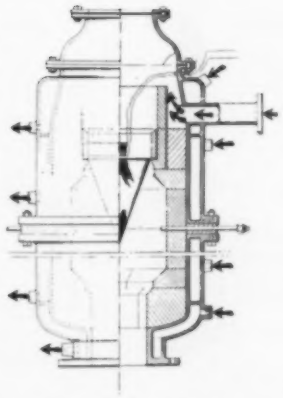

FIG. 2. **Reactor for autothermic synthesis.**

Catalyst Selection and Composition

Platinum is in every instance employed as the catalyst base. It is generally used as a gauze, mounted inside the reactor . . . similar to the ammonia oxidizers which serve in nitric acid production. Or, granular catalyst may be provided, with platinum is supported on an inert carrier, e.g. naturally occurring beryl, a beryllium aluminum silicate.

Pure platinum is not suitable in this service. Under the conditions of hydrogen cyanide synthesis (950 to 1250 C), platinum is subject to recrystallization and volatilization, resulting in loss of weight and activity as well as early mechanical breakdown of the catalyst.

Better performance is obtained if the platinum is alloyed with 10 to 20 percent rhodium. In using such an alloy, however, creeping will occur, and it is necessary to support the catalyst gauze on ceramic rods to maintain mechanical strength.

At one commercial installation, the catalyst consists of a platinum alloy containing ten percent rhodium. The metal is provided in the form of 0.08 mm diam wire spun into a gauze containing 1024 mesh per sq cm. Several such screens are laid above each other, with the bottom gauze supported on ceramic rods. The point of support is subject to greatest wear and some authorities thus prefer to use a heavier-gage wire at the bottom.

Commercial catalyst installations of this type have had successful onstream life of as much as 4000 hours. Indications are that the useful life may even reach as high as 8000 hours.[20,22]

The catalyst gauze reaches a temperature of 920 to 980 C. Andrussow[20] points out that supported granular catalysts can safely be operated at temperatures 50 to 80 C higher than the practical limit for platinum alloy gauze.

Synthesis Unit Process Flow

These key operations are involved in the autothermic synthesis of hydrogen cyanide: Proportioning, mixing and filtering feed gases; reacting the mixture to produce a combustion products mixture containing HCN, unreacted NH_3 and waste gases; removal of the NH_3; collection and purification of the HCN content of the residue.

Commercial processes differ in execution of these various unit operations, especially in the method by which ammonia and HCN are separated. These separation aspects will be discussed in the next part of this series.

The process shown in Fig. 1 is illustrative of the general flow scheme employed in autothermic HCN synthesis. Here, the feed gases . . . ammonia, methane, air . . . are filtered, proportioned and mixed en route to the converter. Reactor gases pass through a waste-heat boiler where they are cooled to 150 C, and enter the ammonia removal system.

In the example here, sulfuric acid absorption is shown for the ammonia removal step. Where this approach is selected, ammonia is obtained as ammonium sulfate which is recovered by crystallization from the absorption tower's rich liquor.

Ammonia-free gases, from the top of the absorption column, are fed to the bottom of a scrubbing tower operated at 5 to 10 C. HCN is absorbed in slightly acidified water; its concentration in the rich liquor ranges from 3 to 20 percent, depending on the pressure at which the system is operated. Lean gas leaving the tower top is flared.

A fairly simple distillation step strips HCN from its water solution and purifies the product to better than 98.5 percent concentration. This is liquefied and stored at 5 C in the presence of a stabilizer to prevent spontaneous . . . and explosive . . . polymerization of hydrogen cyanide. Phosphoric acid in a concentration of 0.2 percent by weight is commonly used as the inhibitor.

In typical commercial performance, production of one pound HCN consumes 1.05 to 1.08 lb methane and a net of $.75 lb ammonia. If sulfuric acid absorption is used for ammonia removal, gross ammonia consumption is 1.05 lb and approximately 0.3 lb is recovered as ammonium sulfate. In an alternative absorption technique, to be described below, unconsumed ammonia is recovered as such and recycled to the reaction stage.

Feed Purity Is Important

Purity of feed methane is a critical consideration in the operation of autothermic HCN synthesis. Sulfur and phosphorus compounds, which deactivate the platinum catalyst, are particularly objectionable. Short-term exposure of these catalyst poisons appears to be reversible and activity is restored with use of sulfur and phosphorus-free gas. Long-term exposure to compounds of this type causes permanent physical damage to the platinum gauze.[20]

Presence of higher hydrocarbons leads to soot formation and premature catalyst deterioration. Most objectionable are olefins and C_3 and higher hydrocarbons, but even ethane causes damage and its concentration in the methane feed should be reduced to less than one percent, preferably.

It is permissible to have the cold feed gases saturated with water. It is observed that resulting decomposition of methane is minor. Furthermore, the reactor gases contain some 20 percent H_2O regardless. The small amount of moisture which may be introduced with feed gas is of little consequence.

Ammonia. The only objectionable impurity likely to be present in technical ammonia are small particles of oil. Their removal can be effected by various means. Probably the most effective way is to mix ammonia into feed air by passing the latter through an aqueous ammonia solution.

Air is universally employed as source of oxygen for the process. If capacity of the equipment is limited, there would be some gain in using oxygen enrichment, since this would decrease the amount of inert gas which must be processed. However, the economics of the operation generally favor use of air as oxygen source.

Dust particles must be removed from the feed gases since they would clog the catalyst screen and since iron, particularly, is a catalyst poison. Normal approach is to filter the feed gases separately because the ammonia reacts with carbon dioxide and water vapor in the air and natural gas to yield solids which clog up the filters. According to Inman[10] though, the final reactor feed mixture may be filtered without difficulties from clogging, if the operation is carried out at a temperature above 70 C.

To insure absence of dust and oil from its feed ammonia and air, one commercial installation even goes to the extent of preparing the reactor mixture by passing air through aqueous ammonia and joining the resulting stream with methane.

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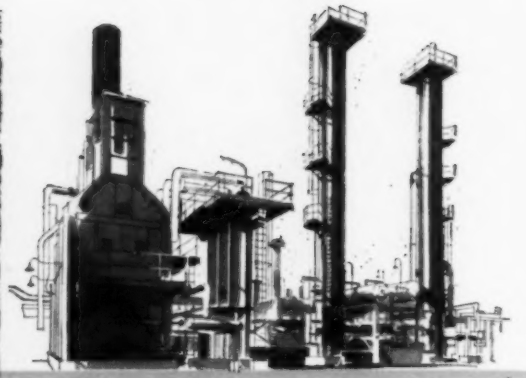

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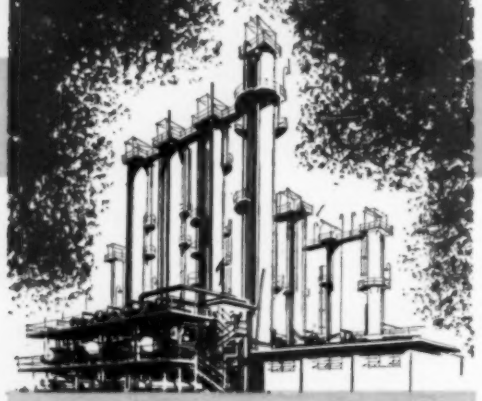

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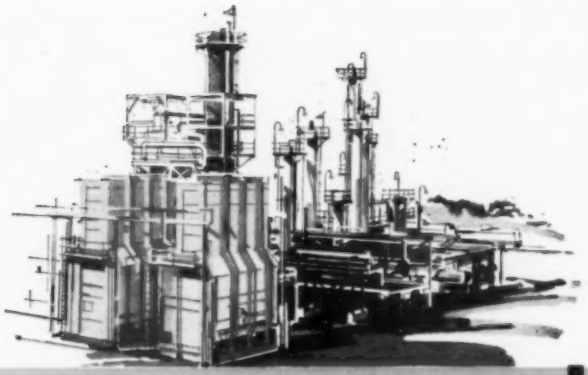

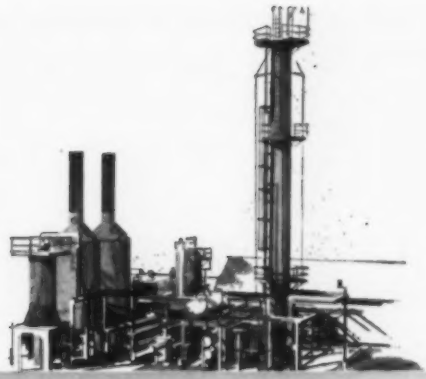

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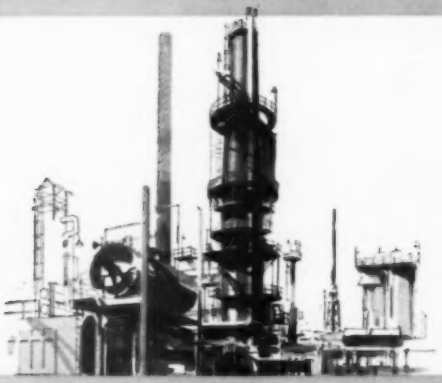

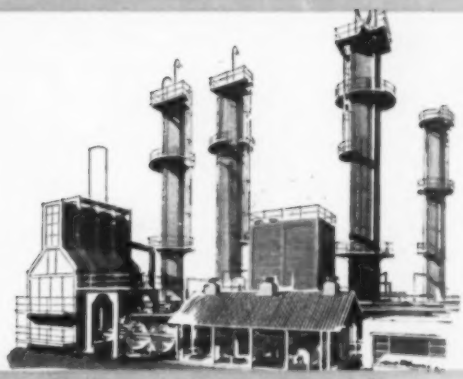

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How HCN Synthesis Reactors Are Designed

Non-catalytic reactors. Although the autothermic synthesis of HCN is carried out commercially in the presence of platinum alloy catalyst, its non-catalytic execution deserves brief mention.

As noted earlier, essentially the same distribution of main products and by-products is obtained with or without catalyst. It is the function of the catalyst to expedite the overall reaction system rather than to guide it. For commercially tenable conversion rates, non-catalytic operation calls for temperatures 200 to 300 C above those used in a catalytic system. The necessary increase in temperature may be achieved by oxygen enrichment, by lower ammonia content of the feed gas, or by higher preheat (up to 800 C).

The non-catalytic reaction proceeds in a flame. According to McKinnis,[12] it is essential to design the reactor and gas flow so that the flame will be thin and flat, to permit short contact time. Principles for designing reactors toward meeting this objective, are stated by McKinnis[12] and by Sherwood,[26] among others.

Catalytic Converters. The more important catalytic synthesis of hydrogen cyanide is carried out in two types of reactors. One of these is of fixed-bed design and granules of supported platinum serve as catalyst.

Commercially more significant are combustion chambers of the type employed in the oxidation of ammonia to nitric acid, a closely related reaction. Here, platinum alloy is provided in the form of a gauze or screen, set into the path of the process gases.

Details of burner design in this technology have been reported elsewhere[27,28,29] and we need call attention to only two of the more important reactor types.

In one of these, the catalyst gauze is laid horizontally, at right angles to the flow of gas. Several layers of screen are employed, and the bottom gauze is supported on ceramic rods. The inlet portion of the reactor must be tapered so that the linear gas velocity will be essentially uniform over the entire area of catalyst screen.

An interesting, novel type of converter for HCN synthesis is shown in Fig. 2. Here, the catalyst is provided in the shape of a cone and does not require support. The converter entrance is shaped to promote uniformity of gas flow.

Aluminum is one of the few metals capable of handling the reactor gases. However, as the stream emanates from the burner area proper, it is too hot for immediate contact with aluminum and the walls immediately downstream of the catalyst screens are lined with refractory.

Reaction Conditions

Gas fed to the catalytic area has the following typical composition:[22]

$NH_3 = 11-12$ vol %
$CH_4 = 12-13$ vol %
$H_2 = 2-3$ vol %
Air $= 72-75$ vol % ($= 15.0-15.6\%$ oxygen)

This composition shows a slight deficiency in oxygen, if measured in terms of the main reaction (Equation 3), but it should be noted that some direct reaction between ammonia and methane occurs, (Equation 1) and that this also results in HCN formation.

Presence of hydrogen in the indicated concentration range is not harmful to reaction progress or durability of the catalyst. Nor does it create any explosion hazard since the presence of ammonia in the system lowers the explosive limit below the danger point.

Despite absence of serious explosion hazard at steady-state conditions, it is necessary to provide explosion discs both preceeding and following the converter. It is also advisable to employ automatic control valves to cut off the flow of methane in the event of any interference with supply of ammonia to the reactor. During start-up ammonia concentration is allowed to build up before methane is turned into the system. And, methane is the first stream to be discontinued during an intentional shutdown.

When a burner is started up, the reaction is initiated by heating the platinum gauze—usually by passage of electric current through it. Once the reaction has taken hold, however, it becomes self-supporting and no further heat supply is needed. Catalyst temperature at steady-state is approximately 1000 C.

Useful conversion in a single pass is limited to about 60 to 67 percent of the ammonia, 53 percent of the methane. The claim has been made[30] that operation at 30 to 40 psig permits 7 to 9 percent higher conversion than is possible at atmospheric pressure. According to Andrussow,[20] the improvement, which has been ascribed to pressure, is reported for conditions which are not optimum for atmospheric pressure operation.

Choice of operating pressure therefore depends upon factors other than its effect on reactor performance. By operating at elevated pressure, smaller absorption equipment may be selected. A further advantage of elevated pressure is formation of a stronger aqueous HCN solution in the primary recovery stages. Against these benefits, proponents of low-pressure operation cite the cost of compression and the health hazard which exists when HCN-containing gas is handled under pressure. At least one commercial plant[22] is operated at slightly negative pressure at all points downstream of the catalyst. A slightly positive pressure is, however, maintained preceding the catalyst chamber in order to avoid accidental introduction of excess air into the system.

Cooling Section

Upon leaving the catalytic burner, the gases are cooled quickly to minimize subsequent degradation reactions.

In most commercial installations a waste-heat boiler is provided to recover at least part of the reaction gases' sensible heat. Some six to seven pounds steam per pound HCN can be made in this manner.

There is some question what should be considered the best temperature for admittance to the waste-heat boiler. From point of view of thermal efficiency alone, it is obviously desirable to have the boiler receive the reaction gas at its reactor exit temperature, 1000 to 1200 C.

This raises several problems, though. Aluminum, which offers the best corrosion resistance to the reaction gases, does not have adequate mechanical strength above 600 C. Further, HCN in the presence of ammonia and moisture forms polymerization products referred to as "azulmic acids," with resultant loss of useful product and formation of deposits which foul the heat transfer surfaces.

According to Merrill,[15] the formation of azulmic acids can be almost completely suppressed by injecting into the hot gas stream fine droplets of water in an amount sufficient to cool the gaseous product below 300 C. In this version, the need for fine droplets of water is emphasized. This will result in rapid evaporation and should avoid the polymerization of HCN which occurs if the hot gas remains in prolonged contact with liquid water.

Chatelain[17] suggests for quenching below 400 C. He claims that polymerization losses can be avoided, even in contact with a liquid water phase if the quenching medium is maintained on the acid side. Toward this end, he recommends the use of aqueous solution of a boric acid-polyhydroxy complex which is of acidic character. This solution may serve as quenching agent by spraying or in a contact column. Here, too, the time for cooling from reaction temperature to 400 C should be brief, preferably of the order of one-tenth of a second.

[References and bibliography will be given in the next and concluding chapter.] ★ ★ ★

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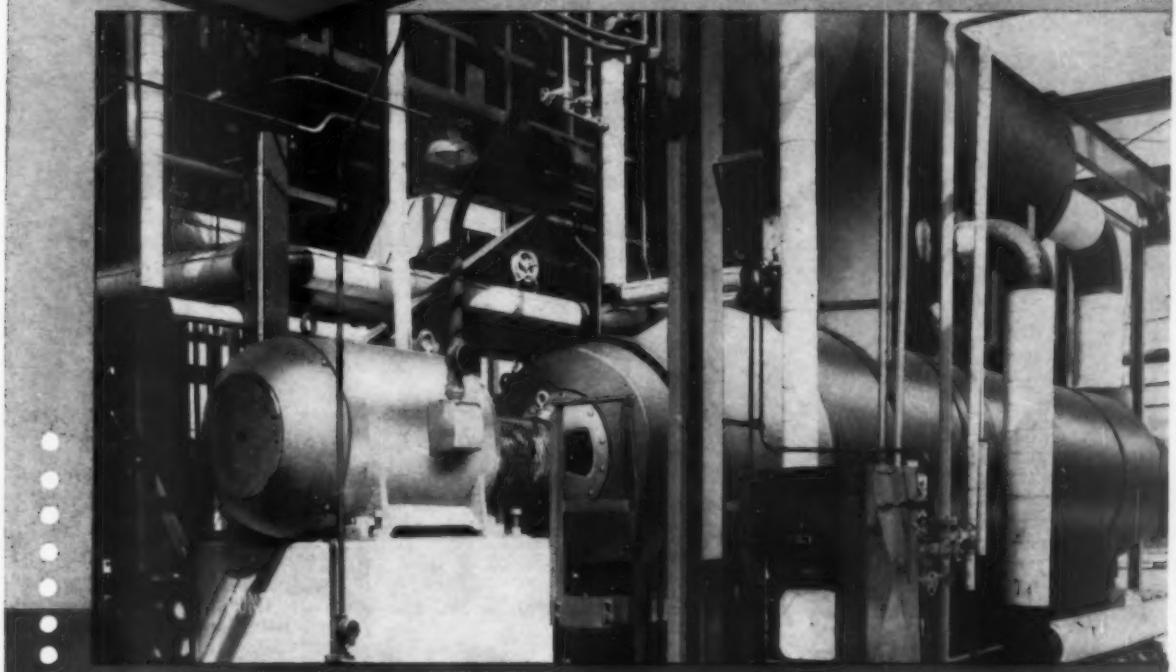

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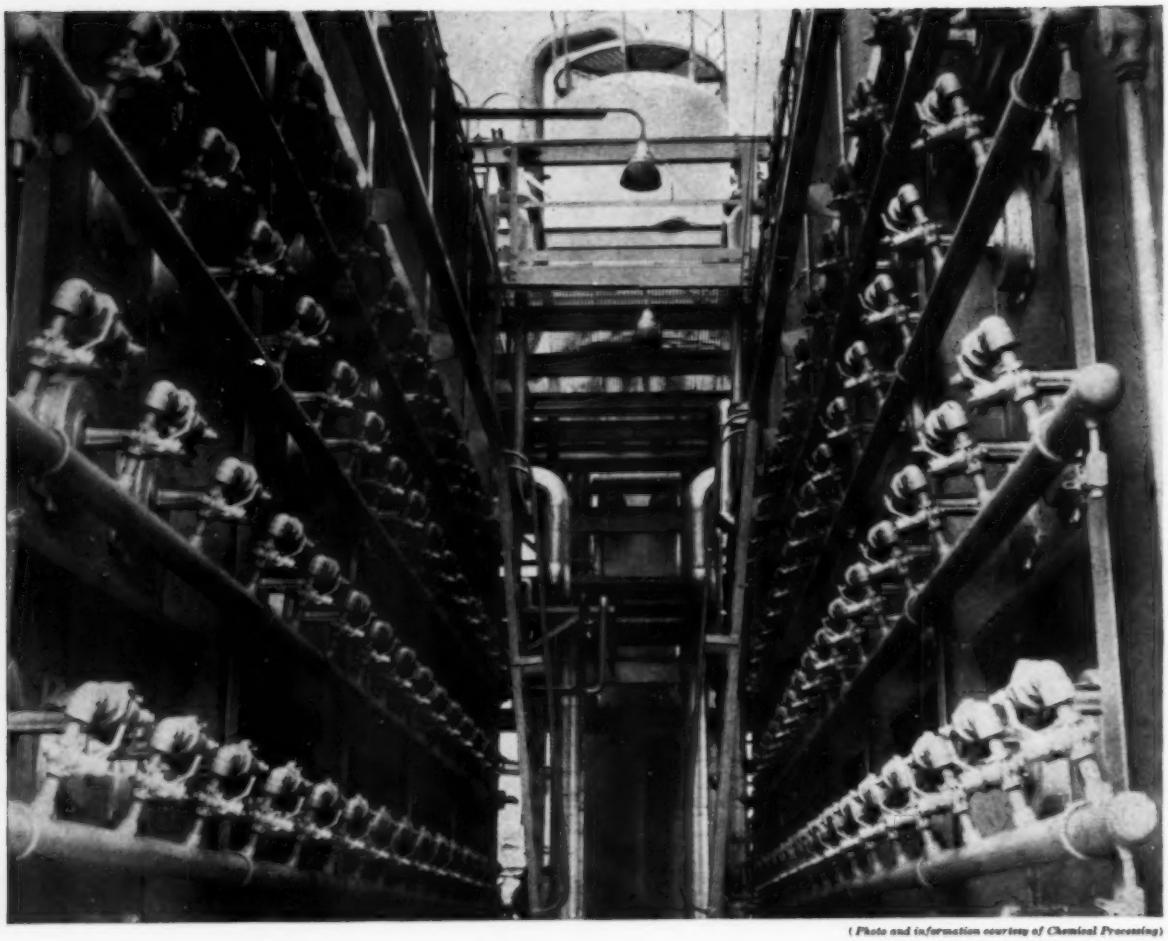

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DESCRIPTION: This liquid-liquid extraction process is used for the production of high quality lubricating oils by the removal from the charge oil of undesirable components including those relatively unstable to oxygen, those with low viscosity indices, color bodies, resins, carbon forming constituents and sulfur compounds. Furfural is a non-acidic, non-toxic and very selective solvent. It may be applied to a wide range of distillate and residual fractions.

The high specific gravity of furfural provides quick, complete separation of phases in countercurrent extraction towers of relatively small diameters or centrifugal extractors. The high critical solution temperature of furfural permits its application to waxy or viscous oils at temperatures where treatment is in the non-viscous, liquid wax range.

In tower operation the charge oil is introduced substantially below the top at a predetermined temperature. The raffinate and extract phases flow from the top and bottom of the tower respectively to recovery facilities for recovery of furfural for reuse.

A substantial temperature gradient is maintained between the top and bottom of the extraction tower. The extraction efficiency can be maintained at a high level by controlled recycle of the extracted material.

YIELDS:

The yield of raffinate from any particular stock and utilities required depend upon the nature of the charge stock and degree of refining desired, i.e., yields may vary from less than 50% to more than 95%. Charge stock and products from typical Mid-Continent crude oils:

Physical Characteristics	Distillate	Deasphalted Residuum
CHARGE —		
Gravity, °API	25.4	23.1
Viscosity SSU at 210°F.	69.3	132.6
Con. Carbon Residue, Wt. %	0.52	1.42
RAFFINATE —		
Gravity, °API	30.9	29.6
Viscosity SSU at 210°F.	58.4	102.3
Con. Carbon Residue, Wt. %	0.03	0.20
Viscosity Index (Dewaxed to 0°F. Pour)	96	95
EXTRACT —		
Gravity, °API	9.5	13.9

SERVICE FACTOR: 95 percent

UTILITIES:	Per Barrel Feed
Steam at 300 psig	40 lbs.
Power	1.0 KWH
Cooling Water	1000 gals.
Fuel	285 M BTU

CHEMICALS:

Solvent loss is generally appreciably less than one tenth of one percent of the oil treated.

OPERATING PERSONNEL:

The process requires few operators. One 3,000 BPD unit is operated by one man per shift although two men per shift are normally employed. A few very large units employ three men per shift.

INVESTMENT:

Investment cost of a specific unit depends primarily upon capacity but also the degree of refining required. Cost estimates of specific units are furnished to prospective licensees of the Process by the Licensor.

MAINTENANCE:

Labor and materials, approximately 3% of investment, annually.

Solvent Dewaxing Process

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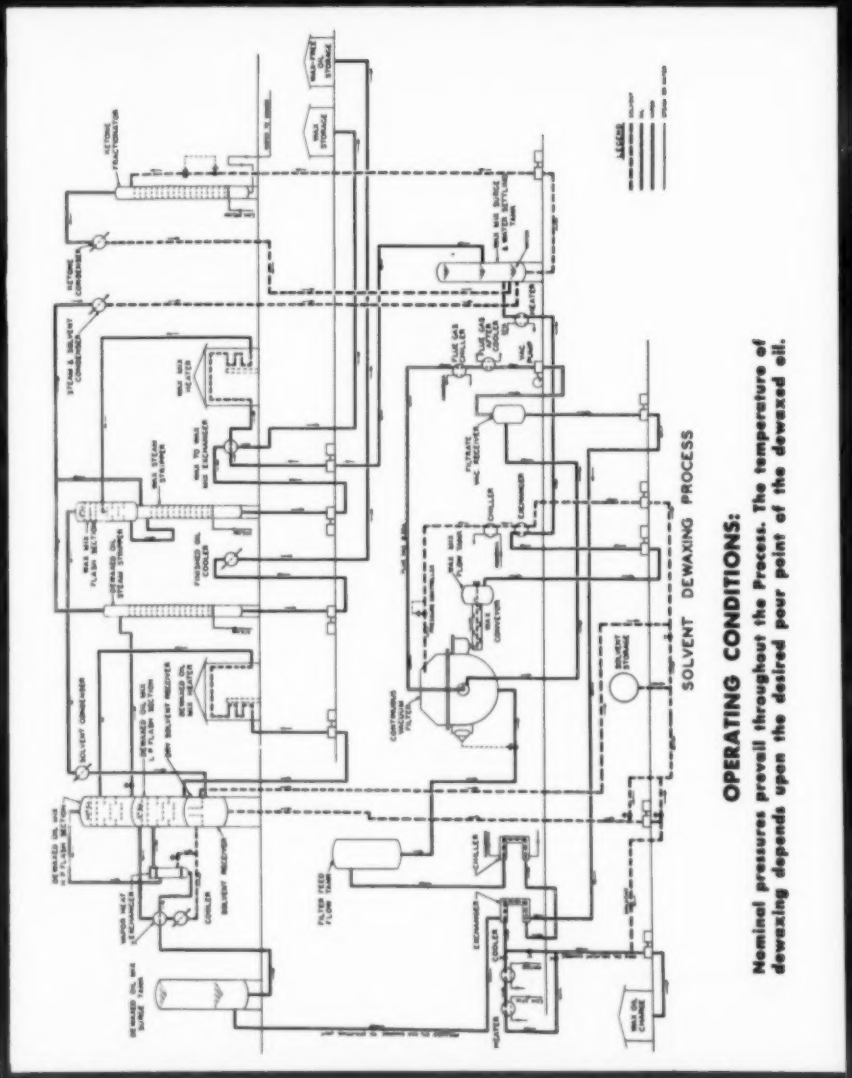

SOLVENT DEWAXING PROCESS

OPERATING CONDITIONS:

Nominal pressures prevail throughout the Process. The temperature of dewaxing depends upon the desired pour point of the dewaxed oil.

Solvent Dewaxing Process

Licensed by: Texaco Development Corporation

DESCRIPTION: The Solvent Dewaxing Process generally employs a ketone-aromatic solvent mixture to obtain, from either distillate or residual stocks of practically all viscosity grades in the unrefined or refined state from any crude source, dewaxed oils with pour points equal to or within a few degrees of the dewaxing temperature.

In commercial operation the dilution solvent is introduced into the wax-bearing oil in such amounts and at selected points in the chilling cycle, as to insure a wax crystal structure and liquid viscosity most suitable for separation by filtration. Solvent dosages vary from a solvent-to-oil ratio of 1.0:1 to as much as 4.0:1, depending upon the nature and viscosity of the charge stock.

The charge mixture is pumped through commercial double-pipe, scraped surface exchangers and chillers to enclosed, drum-type, vacuum filters for removal of crystallized wax. The wax cake is washed on the filter continuously and automatically with cold solvent to produce a wax with very low oil content.

The oil-solvent solution and the wax cake discharged from the filter are pumped through exchangers to separate solvent recovery facilities for recovery of the solvent for reuse.

YIELDS:

The utilities required and the yield of dewaxed oil from any particular stock depend upon the wax content of that stock and the desired pour point of the dewaxed oil. Proper control over all operations results in substantially complete separation of oil from wax. Charge stock and product oil typical of paraffinic solvent refined distillate:

Physical Characteristics	Charge Oil	Dewaxed Oil
Gravity, °API	30.6	29.1
Flash, °F. COC	420	420
Viscosity SSU at 100°F.	—	182.0
Viscosity SSU at 210°F.	43.5	45.1
Viscosity Index	—	95.5
Pour Point, ASTM	85°F	0

SERVICE FACTOR: 95 percent

UTILITIES:	Per Barrel Feed
Steam at 300 psig	40 lbs.
Power	12.0 KWH
Cooling Water	2300 gals.
Fuel	290 M BTU

CHEMICALS:

With good maintenance very low solvent losses exist and are accounted for by mechanical losses.

Refrigerant losses are dependent upon type of refrigerant used, but in any event are insignificant in a plant receiving normally good maintenance.

OPERATING PERSONNEL:

Process is simple to operate and size of the unit influences number of men required per shift, which usually varies from about three men for a plant producing 1000 BPD of dewaxed oil, to about five men for a large plant.

INVESTMENT:

Investment costs of a specific unit depend primarily, of course, upon the capacity but also upon the number of stocks processed, their viscosity, wax content and the desired pour point of the dewaxed oil. Estimates of cost of specific units are furnished to prospective licensees of the Process by the Licensor.

MAINTENANCE:

Labor and materials, approximately 2% of investment annually.

Furfural Refining Process

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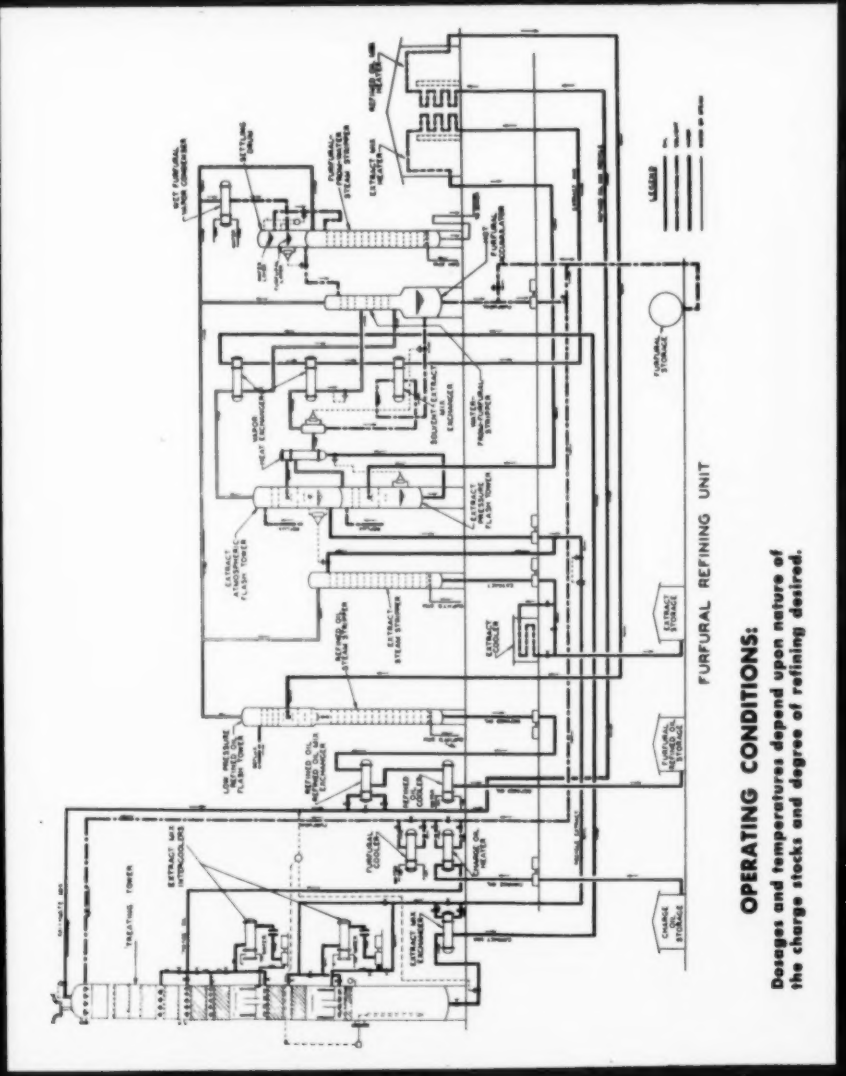
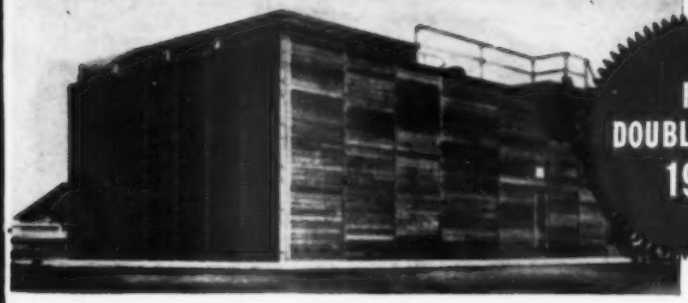


FURFURAL REFINING UNIT

OPERATING CONDITIONS:

Dosages and temperatures depend upon nature of the charge stocks and degree of refining desired.



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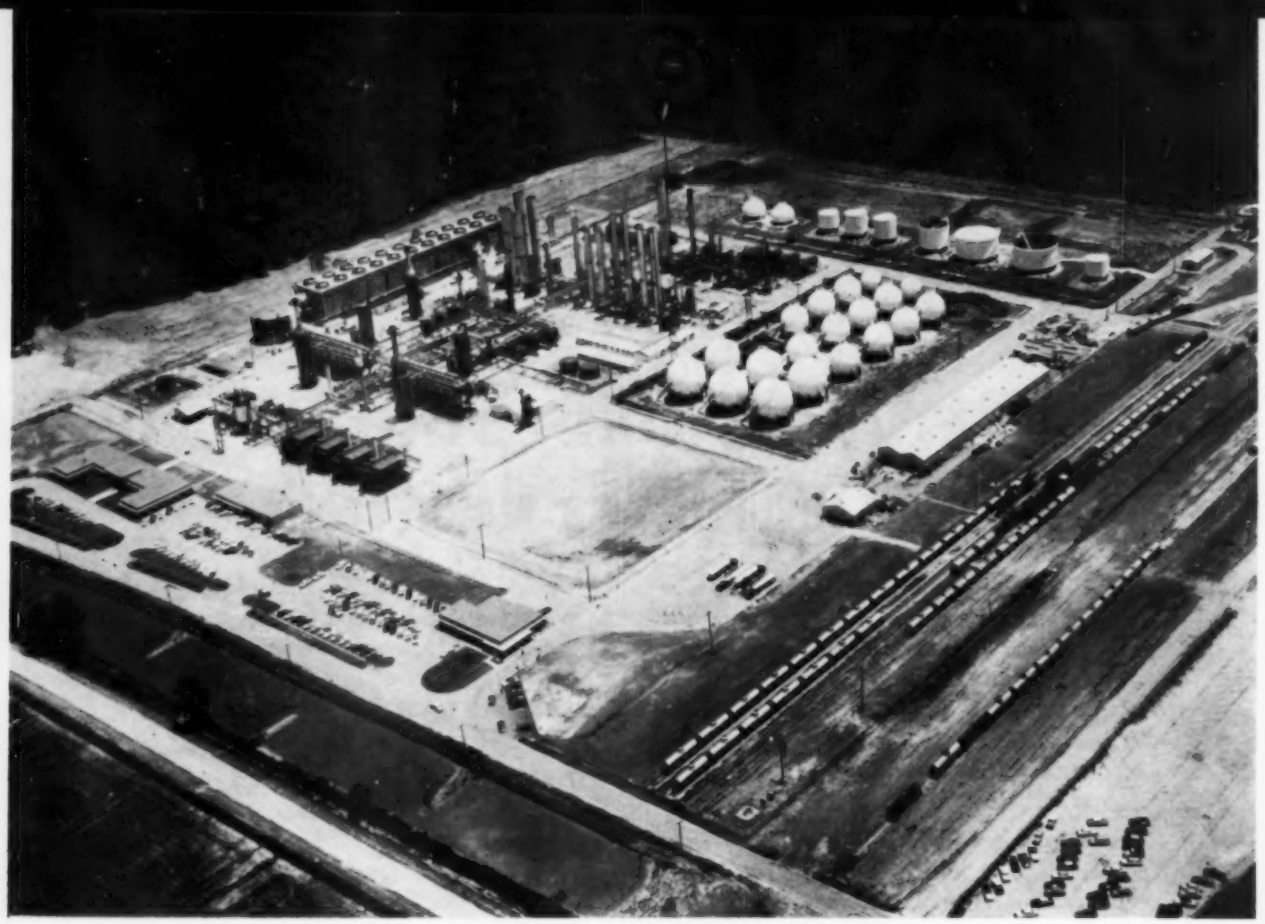

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BUTADIENE—Brighter Horizons?

Production may reach 80 percent of present capacity by 1962 or 1963. Current emphasis is on improving efficiency of present plants

Dr. C. A. Stokes
W. C. Franklin
L. J. Scofield
Texas Butadiene and Chemical Corporation

SINCE the beginning of 1957, there has been a radical change in the butadiene picture. In the time since then, the market pendulum has swung from a tight supply situation to one of gross oversupply. The industry is expected to operate at only about 60 to 65 percent of capacity in 1958. This is because of broad expansion of production facilities in 1957 and 1958, a situation aggravated by the recent business recession.

As we move toward the end of 1958, however, the outlook is improving. Demand is picking up with increasing business activity, and there are high hopes for improved 1959 sales in the automobile industry, principal consumer of the synthetic rubbers that are dominant end-use products of butadiene.

Few New Butadiene Products Ahead

It may well be said that as synthetic rubber goes, so goes butadiene. Even after three years in private hands, butadiene has found no new large scale outlets as a chemical intermediate or even as a monomer for elastomers other than SBR and NBR. Unfortunately for butadiene producers, this condition will almost surely continue for several years longer. The development for cis-polybutadiene as a substitute for natural rubber holds considerable promise but there are some forbidding technological barriers that have yet to be overcome.

Although foreign demand for synthetic rubber is increasing, foreign rubber plants now coming onstream, or planned, will supply a large portion of this demand and it is expected that exports of synthetic rubber from the U. S. will decrease over the near term. This situation will have some softening effect on domestic butadiene demand. And exports of butadiene will consist of only a few spot movements, since the foreign synthetic rubber plants will be

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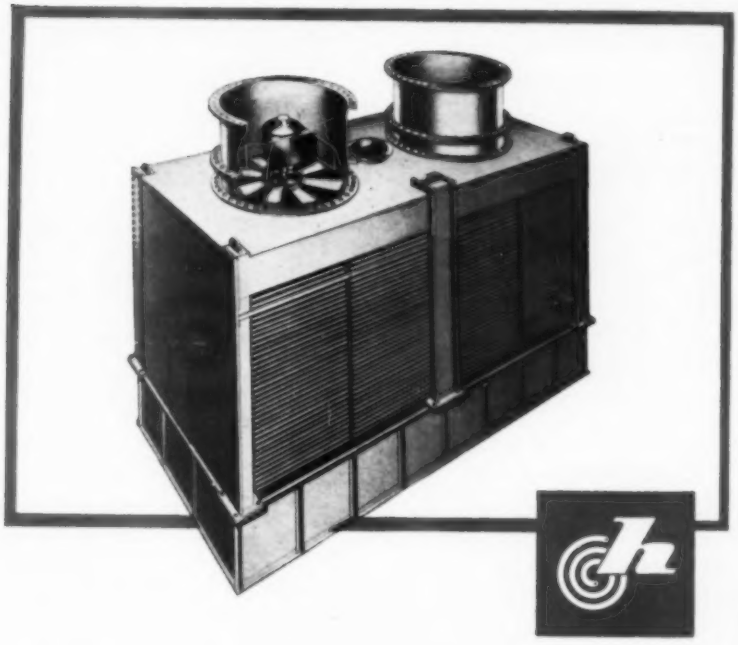

AND . . .

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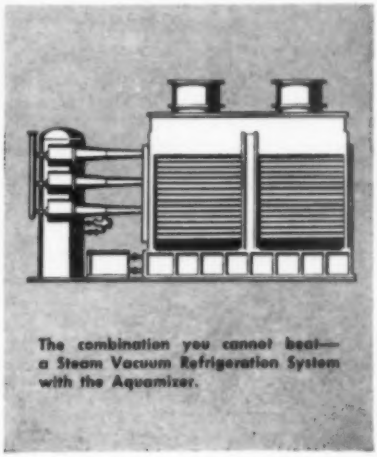

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About the authors . . .

Dr. C. A. Stokes *is presently vice president and technical director of Texas Butadiene & Chemical Corporation. He received his BS in chemical engineering from the University of Florida and his ScD from MIT. Before joining TB&C in August 1955, Dr. Stokes was an assistant professor at MIT and later director of research and development for Godfrey L. Cabot, Inc.*

W. C. Franklin *serves in a sales capacity with Texas Butadiene & Chemical Corporation. He received his BS in chemical engineering from Texas A&M and before joining TB&C in October 1957, served as a production department head for Union Carbide Chemicals at Texas City, and later as district engineer in Houston for C. F. Braun & Company.*

L. J. Scofield *is manager of market research for Texas Butadiene & Chemical Corporation. He has served in market research capacities for the past 15 years and was formerly manager of market research for Dayton Rubber Company. He joined TB&C in January 1958.*

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virtually self-sufficient in butadiene for the time being. Following 1960, there may be a period of a year or two during which butadiene exports will pick up. But over the long pull, it is felt that butadiene consumption will still depend largely on domestic SBR consumption plus the remaining SBR exports.

If industry projections are correct, butadiene will not be produced at 80 percent of industry capacity until 1962 or 1963. And it would seem that there would be no basic reason to begin expanding existing capacity prior to that time. However, certain special situations and technological improvements may result in expanded capacity at one or more of the existing plants.

Significant Process Developments

Since 1955 there have been several highly significant process developments in the butadiene industry. A thorough review of the present state of the butadiene art was given by Reidel in an outstanding series of articles* appearing late in 1957. This series should be consulted for details of the developments summarized here.

First of these is the development of Dow type "B" catalyst which improves butylene dehydrogenation. After plant development work by Polymer Corporation at Sarnia, Ontario, the process was readied for license by joint agreement between Dow, Polymer, and Esso. Subsequently the process was installed in the Neches butadiene plant owned by Texas-U. S. and Goodrich-Gulf. The Dow catalyst, which meanwhile has been in continuous operation at Sarnia, came onstream successfully at Neches in two new dehydro units during the latter half of 1958.

The new catalyst was developed primarily to raise yield on the relatively expensive and often scarce butylenes. However, higher conversion levels have also been reached so that plant capacity can be boosted very significantly due to both yield and conversion (production rate is proportional to the product of these). With bottleneck removal and switching of the rest of the units to "B" type catalyst, the Neches plant could reach nearly 500,000 tons per year of capacity, making it probably the largest single-product petrochemical plant in the world.

Second major development is the reintroduction of the Houdry one-step butane dehydrogenation process for the production of butadiene and butylenes. Within the past two years, four U. S. and one German company have chosen this process for butadiene production. In all, eight Houdry units have been installed in six plants including the Standard of California unit at El Segundo, which dates from World War II.

The Houdry process offers a major advantage in raw material cost over butylene dehydrogenation due to the lower cost of the butane and lack of need for a feed preparation step. During the next few years, it is expected that the experience presently being gained with this process will result in improved capacity of existing Houdry units.

Continued development of the Shell type 205 catalyst and the process of using it can be expected. This catalyst represented a substantial improvement over the earlier "1707" catalyst used during World War II and has been subsequently used in most butylene dehydrogenation units.

Since butadiene manufacture by all of the processes requires relatively large amounts of heat both for direct firing and for steam generation, we can expect much engineering emphasis on improved heat economy. The Houdry plant in Germany, for example, has equipment installed to recover heat from the regeneration air exhaust and the product stream as well.

In the recovery section of the process, a notable improvement has been the use of acetonitrile by Shell for butylene concentration. This extractive distillation technique is also applicable to butadiene recovery where it shows an appreciable capital cost advantage and may show conversion cost savings as well. New plants can be expected to use acetonitrile and some older units may in time be converted.

Economic Plant Size Larger

Increasing production costs and the squeeze between rising raw materials costs and stable selling price have boosted the economic size of a new grass roots plant from 50,000 tons per year to nearer 100,000 tons per year. And the current outlook is for further increases in costs, particularly for butylenes, which will become increasingly valuable to refiners as alkylation feedstock.

In summary, the next few years should show a slow but steady increase in butadiene consumption, but still well below the capacity of existing plants to produce it. There will be little change in end-product distribution, synthetic rubber remaining the major consumer in about the same proportion as now. Technological advances will benefit conversion, yields and recovery. But in spite of such improvements, the economic size of a grass roots butadiene plant is increasing rapidly due to rising construction and raw materials costs, squeezing against a stable sales price ceiling. ★ ★ ★

*John C. Reidel, *Oil and Gas Journal*, November 11, 1957, December 2, 9, 16, 23, 1957.

"It's only natural to be a little eager for the quitting whistle on Friday, McDull — but MUST there be a COUNTDOWN?"

It's New

Refining - Processing Equipment

For Complete Information on Items Described Here, Use Enclosed Reply Card.

New Monitor Series

High-pressure moisture monitors capable of measuring trace quantities in gases, gaseous mixtures and vapors at sample pressures up to 10,000 psig have been announced by *Consolidated Electrodynamics Corporation.*

Circle number (41) on reply card.

Toxicity Detector

Hazardous amounts of hydrogen fluoride in air (0.5 to 5 ppm or more) can be measured quickly by means of a color-keyed calibration chart, with a new M-S-A detector offered by *Mine Safety Appliances Company.*

Circle number (42) on reply card.

Electronic Tachometer

Simplified digital measurement of speeds of gasoline engines or electric motors, with continuous indication of rpm (5 legible readings per second) is offered by the Digital Tachometer now offered by the *Dynapar Corporation.*

Circle number (43) on reply card.

Assembly Introduced

Resistant to most salts, alkalis and acids as high as 150 F, a complete rigid polyvinyl chloride flange union assembly is available in sizes from ½ through 4 in. with threaded or solvent-weld sockets. Featuring an O-Ring seal, the PVC is manufactured by the *Walworth Company.*

Circle number (44) on reply card.

Gage Measures Interface

Water interfaces as well as product levels can be measured with new dual operation electronic tank gage. The same basic components are used for both functions. Conversion kits are available for changing installed units. Additional information is available from *Gilbert & Barker Mfg. Co.*

Circle number (45) on reply card.

Lube Oil Flow Alarm

New protective device for force-feed lube systems can be connected electrically to any desired audio, visual, or mechanical warning unit. "Lube-Line Alert" is adaptable with any viscosity oil for pressures up to 10,000 psi, can be installed at each terminal point of lubrication by cutting the line and attaching fittings. More information available from *Manzel, division of Houdaille Industries, Inc.*

Circle number (46) on reply card.

Self-Rating Solvent

Karysol, a rust and scale remover that indicates its loss of dissolving ability by changing color from blue to red, has been announced by the *Guardian Chemical Corporation.*

Circle number (47) on reply card.

Infrared Water Analyzer

Water concentration in ranges from ppm to percentages levels in liquid or gaseous process streams is measured by a new Series 500 Photometric unit made by *Analytic Systems Company.*

Circle number (48) on reply card.

New Process Pumps

Heavy-duty pumps for handling temperatures to 300 F and pressures to 600 psig have capacities up to 1400 gal per min, heads to 650 ft, and discharge diameters from 1 to 4 in. Details on this new line are available from *Ingersoll Rand.*

Circle number (49) on reply card.

Cationic Surface Agent

Corrosion inhibiting, bactericidal and foaming properties are displayed by a new cationic surface active agent, RD-2873-P, developed by the *Chemical Division, Armour and Company.*

Circle number (50) on reply card.

Pressure Tank Barge

Four stainless steel clad tanks are retained within the full decked hopper space of a 240 ft long, full ocean going barge. Certified to carry nitrogen solutions, food products, caustic soda and molasses by the U. S. Coast Guard, the barge is also classed for carrying Grade "A" products. The diesel-powered barge was recently completed by *Avondale Marine Ways, Inc.*

Circle number (51) on reply card.

High-Temp Chromatograph

This new unit has a maximum operating temperature of 500 C, sufficient to

vaporize samples with boiling points up to 600 C. Designed for laboratory analysts and researchers, it may also be used for all standard chromatographic analyses above 50 C. Bulletin 1847 describes the 26-203 High-Temperature Chromatograph, made by *Consolidated Electrodynamics Corporation.*

Circle number (52) on reply card.

Liquid Level Controller

Designed especially for higher-pressure, higher-temperature liquid level controls now required in power facilities, the newly designed Model 402, an external float cage unit of all welded design, has been announced by *Magnetrol.*

Circle number (53) on reply card.

Industrial Gas Chromatograph

New pneumatic trend recording industrial gas chromatograph has new readout system that offers continuous easy checking, as well as cascade control of process operations. Several pneumatic miniature recorder models present analysis data. Some recorders are 2-pen units which trace trend concentrations of 2 components. *Beckman/Scientific and Process Instruments Division.*

Circle number (54) on reply card.

New Catalyst Supports

Mullite pellets for use as catalyst supports in refining of petroleum products are now available. The pellets are thermally fused spheres of combined alumina and silica, manufactured to the mineral formula of mullite. *W. R. Grace & Co., Davison Chemical Division.*

Circle number (55) on reply card.

High-Capacity Boilers

Line of natural circulation packaged boilers features first units of their kind capable of generating steam at capacities up to 100,000 lb or more per hour. *The Babcock & Wilcox Company.*

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New Refining Literature

Filter Bulletin

Product and property data on industrial filters, including structure, flow rates and cleaning and thermal, chemical and mechanical properties are presented in a comprehensive 4-page bulletin issued by *Corning Glass Works.*

Circle number (57) on reply card.

New Prices Listed

Latest prices for a wide range of laboratory items including water analysis sets, conductivity equipment, chemical reagents, etc. are listed in a 12-page publication issued by *Betz Laboratories, Inc.* Also available is an analytical data sheet prepared on the new Betz Chromate Test, which eliminates all liquid reagents except the usual sodium thiosulfate.

Circle number (58) on reply card.

Tubemanship Brochure

Published to acquaint industry with skills and techniques used in manufacture of seamless copper and copper alloy tubing, including the components of tubemanship, quality control during production, creativity and related customer services. *Wolverine Tube.*

Circle number (59) on reply card.

Antioxidants Bulletin

Discussion of the oxidation mechanism through free radical action introduces a 12-page booklet, "Catalin Antioxidants." There are detailed descriptions and lab data on antioxidants and their applications in gasoline and jet fuels, petroleum oils, rubber, plastics, etc. *Catalin Corporation of America.*

Circle number (60) on reply card.

Temperature Monitor

New bulletin presents basic information on the Kybernetes electronic Temperature Indicator Monitor, made by *Hagan Chemicals & Controls, Inc.*

Circle number (61) on reply card.

Valves Rated

Stainless steel valves are listed according to degree of resistance to corrosive media under varying conditions, in a catalogue issued by *Jenkins Bros.*

Circle number (62) on reply card.

Catalog Released

Forged steel valves, fittings, flanges and unions are listed in a 432 page, thumb-indexed catalog published by *Henry Vogt Machine Company.*

Circle number (63) on reply card.

Silicone Guide

More than 150 silicone products now available are included in a comprehensive reference guide, by *Dow Corning Corporation.*

Circle number (64) on reply card.

Steel Buyer's Guide

About 3000 firms offering goods or services pertaining to stainless steel are included in a 159 page Buyer's Guide, published by the *Committee of Stainless Steel Producers, American Iron and Steel Institute.*

Circle number (65) on reply card.

Simpler Panels Advocated

Basic requirements for efficient instrument panels are discussed in a 12 page Kelloggram, based on the needs of operators and economic plant production. The pamphlet "The Application of Innovation in Engineering Systems" has been prepared by *The M. W. Kellogg Co.*

Circle number (66) on reply card.

Facilities Described

Engineering, manufacturing and research facilities of *Pfaudler Permutit Inc.* are pictured and discussed in a 24-page, customer-oriented booklet, covering the corporation's 4 factories in the United States and 5 foreign divisions.

Circle number (67) on reply card.

Additive System Selection

Titled "Importance of Bulk Terminal Additive Systems," new bulletin features text and graphs explaining which type—meter or pump—additive control to use for various main line flows and volume percent of additive. Also included is selection data table outlining type of additive and recommended equipment to use for each additive. *B-I-F Industries, Inc.*

Circle number (68) on reply card.

Atomic Models Brochures

Revised brochure on LaPine-Leybold line of atom models according to Stuart and Briegleb brings information on uses up to date. New listing is cyclopropane-group carbon atom model. Illustrations show how models are assembled and disassembled. Also available is another brochure on 10 additional atom models used to construct metal chelate molecular models. *Arthur S. LaPine and Company.*

Circle number (69) on reply card.

Insulating and Refractory Material

Four-page folder completely describes Foamsil, new insulating and refractory material, which is 99 percent pure fused silica and has a practical operating range of —450 F to 2200 F. This foamed silica material is unaffected by practically all commonly used acids and by thermal shock. *Pittsburgh Corning Corporation.*

Circle number (70) on reply card.

Torq-Air-Matic Line

New bulletin provides data on complete line of Torq-Air-Matic automatic tube expander drives, which are available for virtually every tube rolling job. Chart included in bulletin lists three basic model types — Model A for condensers and evaporators, Model B for heat exchanges, and Model C for boiler tubes. *Thomas C. Wilson, Inc.*

Circle number (71) on reply card.

Chemicals Catalog In Sections

Expanded and completely revised chemicals catalog is divided into separate sections. Also included are specialty chemicals. A 64-page catalog describes composition, properties, and uses of products. *Antara Chemicals.*

Circle number (72) on reply card.

Refining Personals

C. B. Barry

J. A. Richardson

▸ Formation of a new consulting engineering firm, **Barry and Richardson,** has been announced by **Charles B. Barry,** Tulsa and **J. A. Richardson,** Dallas, Texas. The new firm will offer a complete range of engineering services as process and evaluation specialists to the petroleum, natural gas and chemical industries. Barry has operated as a consultant since 1956 in both the United States and Canada. Richardson was with Seaboard Oil Company for seven years as gas engineer and assistant manager for the gas department. The firm will have principal offices in Tulsa. Richardson will move to Calgary, Alberta, Canada, immediately to service clients in that area.

R. P. Corlew

▸ **R. P. Corlew** has been appointed manager of refineries for **Richfield Oil Corporation.** He succeeds **C. R. McKay,** who has retired after 21 years in that post.

▸ **James I. Harper** has been appointed coordinator of chemical manufacturing and sales for **Sun Oil Company.** He is also president of the **SunOlin Chemical Company,** which was created in the fall of 1958, as a joint subsidiary of Sun Oil Company and Olin Mathieson Chemical Corporation.

▸ **Sheldon E. Beadle, Jr.,** has been named sales representative, petrochemicals department, **Gulf Oil Corporation;** and **Arnold G. Anderson** has been assigned to the commercial research section of that department, succeeding Beadle.

▸ **Gordon J. McCarthy** has been named to the newly created position of assistant manager, crude oil and products supply, with **Leonard Refineries, Inc. David W. Dolson** is manager.

▸ **Dr. R. Tracy Eddinger,** manager of **Eastern Gas and Fuel Associates'** research lab in Boston, has been elected 1959 chairman of the American Chemical Society's Division of Gas and Fuel Chemistry. **Dr. Richard A. Glenn,** of **Bituminous Coal Research, Inc.** was named chairman-elect of the ACS division. **O. P. Brysch,** of the Institute of Gas Technology, will continue as secretary-treasurer.

▸ **Glenn W. Billman** has been appointed supervising research engineer at the Richmond Laboratory of **California Research Corporation.**

▸ **Frank W. Bowen** has been appointed assistant to the vice president in charge of manufacturing for **Sun Oil Company,** the post vacated by the retirement of **W. Henry Linton.**

▸ **Fred P. Sewell,** vice president of manufacturing and marketing for **Delhi-Taylor,** and his assistant, **Carroll C. Cook,** have moved into the company's main offices in Dallas. Manufacturing headquarters formerly were located at Corpus Christi.

▸ **Gael M. Williams,** research engineer with **California Research Corporation,** has been promoted to group supervisor of the technical service division of the firm's Richmond lab.

▸ **Glenn W. Poorman, Esso Standard Oil Company** vice president, has been elected a vice president, director and member of the **Esso Export Corporation. Thomas W. Moore,** vice president of Esso Export, succeeds Poorman as a vice president and director of Esso Standard.

▸ **W. A. Myers** has been appointed acting manager of the **Atlantic Refining** Company's research and development department, assuming the duties of **H. W. Field** who, for reasons of health, has been granted a leave of absence.

▸ **Robert L. Kerr Jr.,** departmental assistant in the power department in the Philadelphia refinery of **Atlantic Refining Company,** succeeds **C. H. Brown** as superintendent of the department. Brown is retiring after 41 years with Atlantic.

▸ Promotion of **Dr. John R. Thomas** to the post of senior research associate at **California Research Corporation** has been announced.

▸ **W. J. Reitze,** manager of sales engineering for **Esso Standard Oil Company,** has been named chairman of the materials division, American Ordnance Association.

▸ Chief automotive engineer-research **Leonard Raymond,** of **Socony Mobil Oil Company,** New York, has been elected president of the Society of Automotive Engineers for 1959.

▸ **Dr. J. H. Paden** is now director of research for the organic chemicals division of the **American Cyanamid Company.** Dr. Paden will make his headquarters at the Bound Brook, New Jersey, labs of Cyanamid.

▸ **Sam H. Casey** has been elected executive vice president of **Commonwealth Oil Refining Company, Inc.,** and will remain in charge of the firm's New York office.

▸ **Dan M. Krausse** of Big Spring has been named one of the Five Outstanding Young Texans for 1958, selected by the Texas Junior Chamber of Commerce. Krausse is senior vice president of **Cosden Petroleum Corporation,** which produces styrene by direct recovery of ethylbenzene from gasoline, a process acclaimed as one of the refining industry's most outstanding recent innovations.

D. M. Krausse

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Personals

▸ **Dr. William E. Bradley,** research manager of the **Union Oil Company,** Brea, California, is the new chairman of the American Chemical Society's Division of Petroleum Chemistry for 1959. **Wheeler G. Lovell,** director of automotive products development, **Ethyl Corporation,** was named chairman-elect of the ACS division. Continuing as secretary and treasurer, respectively, are **Dr. Bernard M. Sturgis** of Du Pont, and **Dr. H. J. Passino,** of The M. W. Kellogg Company.

▸ **Wilfred O. Taff,** an assistant director in the process research division of **Esso Research and Engineering Company,** has been promoted to associate director. **Donald L. Baeder,** formerly head of the exploratory section, has been named an assistant director.

▸ **J. L. Hoelscher,** maintenance superintendent at the **Ohio Oil Company's** Robinson (Illinois) refinery, has been transferred to the general office as senior engineer on the refining engineering manager's staff.

▸ **Dr. Burton C. Belden,** formerly associate director of **Esso's** process research division, has been appointed assistant manager in the company's office of scientific liason.

▸ **William Priestley Jr.** of **Esso** has been given a new, rotational assignment at Esso, as an acting assistant director in the process research division.

▸ Three engineers have been named co-winners of the 1958 Junior Award of the American Institute of Chemical Engineers. **Robert D. Vaughn,** chemical engineer with **Shell Development Company,** California. **A. B. Metzner,** associate professor at the University of Delaware, and **George L. Houghton,** of the **Socony Mobil Oil Company's** research labs in New Jersey, co-authored the winning paper, "Heat Transfer to Non-Newtonian Fluids."

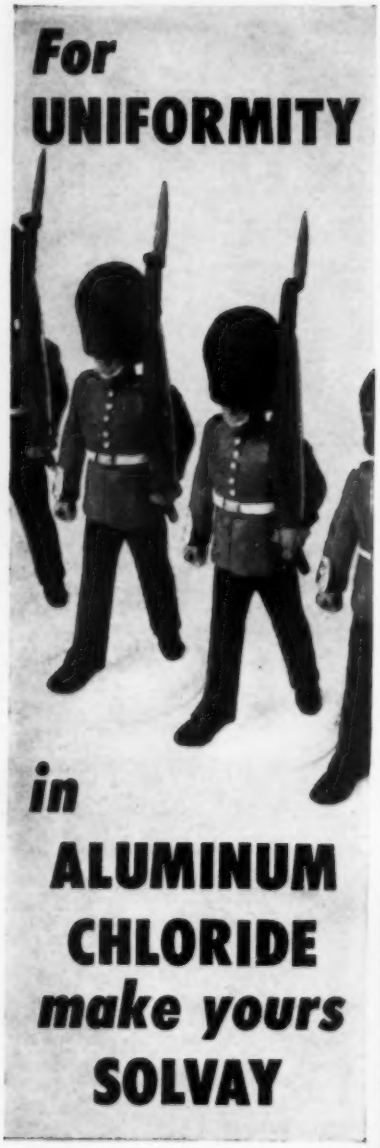
▸ Four appointments have been made to the research division of the newly organized development department of **Petroleum Chemicals, Inc.** The appointments include: **Dr. Robert L. Hellwig,** head, engineering section; **Dr. John W. Sellers,** head, organic section; **Robert S. Munger,** group leader, analytical section, and **Dr. Richard Seekircher,** group leader, chemical section.

▸ **Dr. Leonard G. Tompkins** has been named technical manager for the petrochemicals department of the **Organic Chemicals Division, American Cyanamid Company.** He succeeds **Dr. J. C. Pullman** who has been appointed assistant to the division's commercial development manager.

▸ **Dr. John J. McKetta, Jr.,** University of Texas professor, has been appointed chemical engineering department chairman. Dr. McKetta has served on the University staff 12 years. He is the third chemical engineer in Texas to hold an American Institute of Chemical Engineers national director's post.

▸ **G. W. Ferguson** has been named technologist in the Los Angeles office of **Texaco's** research and technical department. He was formerly on the staff of the manager of technical services at the Texaco research center in Beacon, New York.

▸ **Myles J. Connor Jr.** has been appointed an assistant director in the planning engineering division of **Esso,** and is in charge of the division's research activities.



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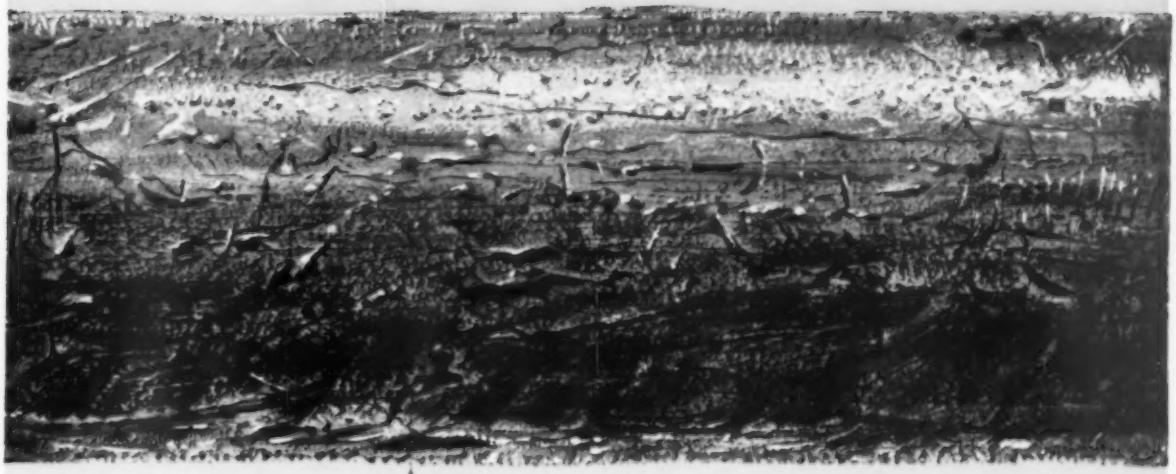

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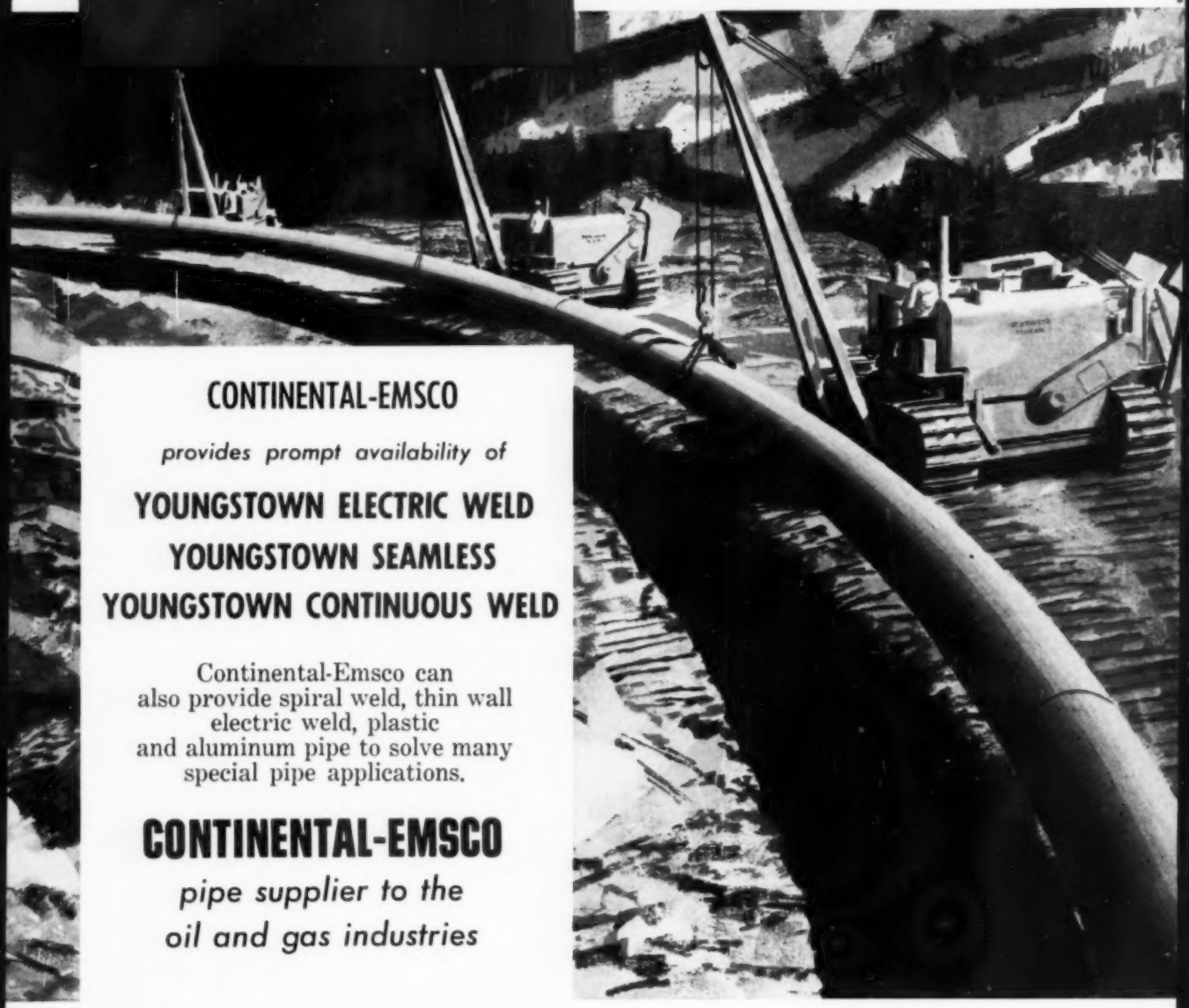

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. . . in Pipelining

A DEFINITE TREND IS DEVELOPING IN NATURAL GAS TRANSPORTATION. This is the purchase of gas in the field by distribution companies and payment of a fee to transmission companies to deliver it for them. That way no Federal Power Commission regulation is involved. The distributor owns the gas all the way from the wellhead to distribution point and there is no interstate movement on the part of the pipeline in the sense that would place it under FPC jurisdiction. A number of contracts have been made on this basis and others are being negotiated.

PIPELINES WILL BE BUSIER IN 1959, according to all indications. The U. S. Bureau of Mines says demand for all oils, domestic and export, will be up 4 percent over 1958. Independent Petroleum Association of America also states that the increase will be in the neighborhood of 4 percent. Eugene Holman, Jersey Standard board chairman, places domestic demand at 5 percent over 1958, and adds that in the rest of the free world industry growth should show an 8 percent increase. Other forecasters are in approximately the same range. Most of this increase will be transported through pipelines already in operation, some through new lines of course.

THE INDUSTRY WILL BE HELPED by a faster disposition of rate cases accumulated as a result of the lower court's decision in the Memphis Case. Now that the U. S. Supreme Court has overruled this decision, the Federal Power Commission announces it can proceed with orderly disposition of a "significant number" of natural gas rate cases. The commission says that more than half of its pending cases involve filings made prior to the lower court's ruling. These older cases will be given priority because of the large money refunds to which customers may be entitled.

PIPELINE OPERATORS ARE VITALLY INTERESTED IN THE LP-GAS PICTURE, as that is a growing phase of the transportation business for many. Phillips Petroleum Company, in its annual study, reveals that total sales in 1958 were 7,591,400,000 gal, an increase over 1957 of 652,300,000 gal. This increase is 30 percent greater than the average annual gain of 500,000,000 gal recorded by the industry since 1950. The report also pointed out there is every indication that 1959 will be another prosperous year for the LP-Gas industry.

NEW USES FOR PIPELINES ARE CROPPING UP EVERY DAY. Recently Continental Oil Company shipped 20,000 bbl of dodecene 500 miles through the Cherokee Pipe Line system, from Ponca City to Wood River. This is believed to be the first large-scale shipment of chemicals by pipeline.

You save in many ways with TEL-O-SET transmitters

... today's most advanced pneumatic transmitters

Measure temperature, gage pressure *or* absolute pressure with the same accurate, highly responsive *Tel-O-Set* transmitter.

CUT INSTALLATION COSTS

Mount the transmitter anywhere, indoors or outdoors—it's weatherproof. Easily installed on wall, pipe or horizontal well.

CUT SPARE PARTS INVENTORY

Only one basic transmitter needed for all applications.
Adjust range without adding or changing parts.

SAVE IN MAINTENANCE

Long life inherent in rugged force-balance mechanism.
All working parts and adjustments protected by weatherproof cover.

Get complete details on *Tel-O-Set* transmitters, receivers, and controllers from your nearby Honeywell field engineer. Call him today . . . he's as near as your phone. MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

Honeywell

● **REFERENCE DATA: Write for Catalog C100-1A, "*Tel-O-Set* Indicators, Recorders, Controllers".**

First in Control

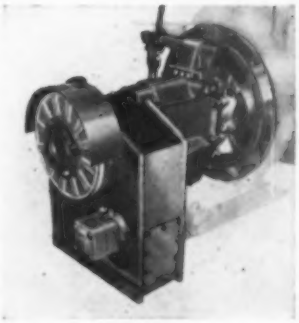
Hyde-Crowd on the Model 774 allows maximum crowding speed for every digging condition.

Exclusive Hydra-Crowd transmission gives up to 25% more ditch per day

No ordinary mechanical ditcher transmission allows the machine to dig at the fastest speed for constantly changing soil conditions. The operator is forced to select a speed slower than the optimum. To change speeds, he has to stop the machine and shift gears. Now, Barber-Greene has made ordinary ditcher transmissions obsolete.

The Hydra-Crowd transmission, exclusive with Barber-Greene Ditchers, is the most efficient transmission on any ditcher. Its infinite range of crowding speeds permits the machine to work at top capacity in every digging condition. It is not necessary to shift gears or stop the machine to change speeds. Operator can increase or decrease speed by merely turning a dial. Crowding can be instantly stopped or reversed.

Hydra-Crowd gives a new high in digging efficiency and economy. It enables Barber-Greene Ditchers to produce more ditch at less cost than any other ditcher of the same size range. Reports from owners indicate that they get 25% more ditch per day when using a Barber-Greene Ditcher with Hydra-Crowd. Hydra-Crowd is just one of the many advanced features of Barber-Greene Ditchers.



Only Barber-Greene has Hydra-Crowd

Write for literature on the ditcher line of advanced design

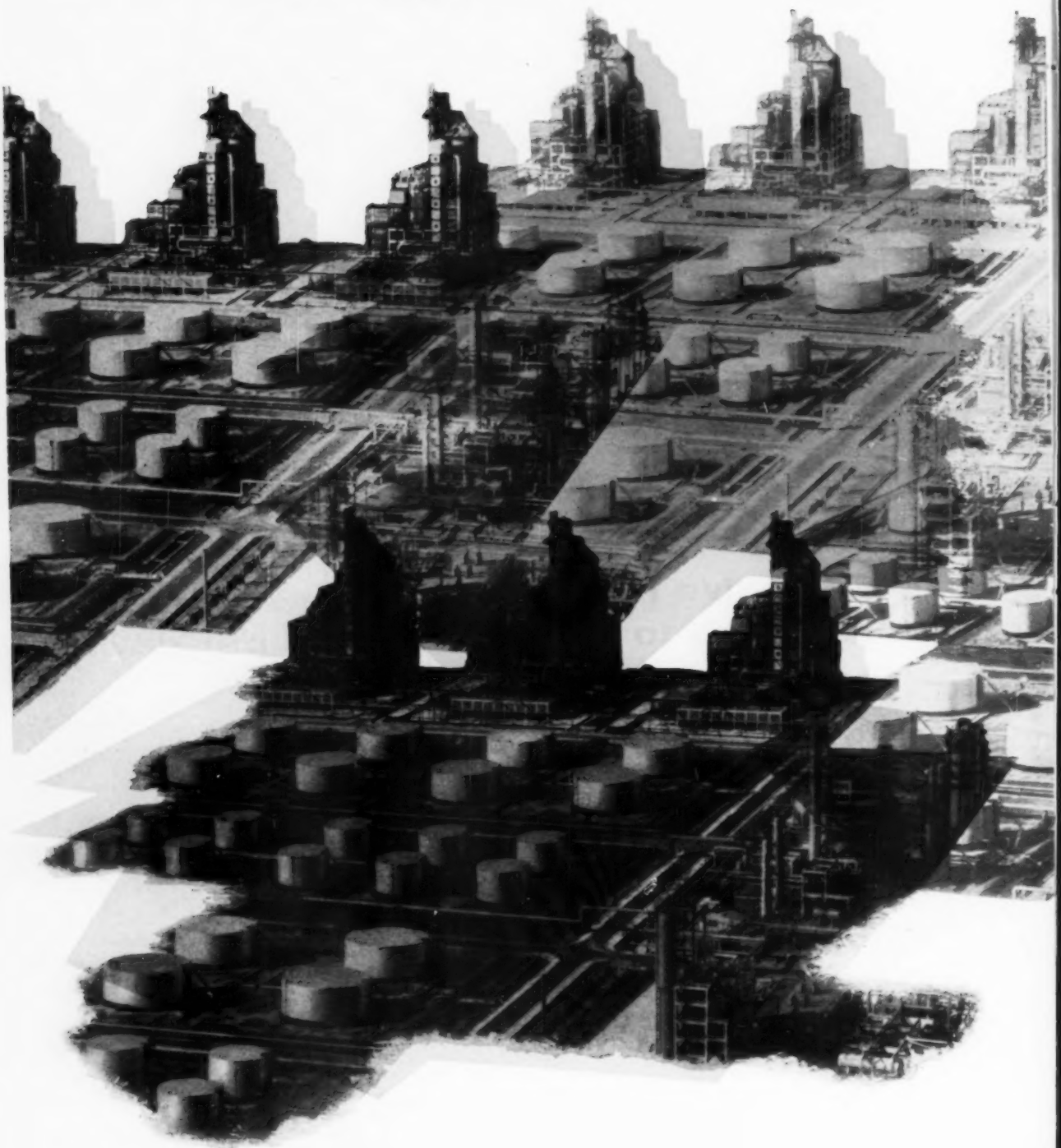
58-26-D

Barber-Greene BG

AURORA, ILLINOIS, U.S.A.

CONVEYORS...LOADERS...DITCHERS...ASPHALT PAVING EQUIPMENT

"Engineered



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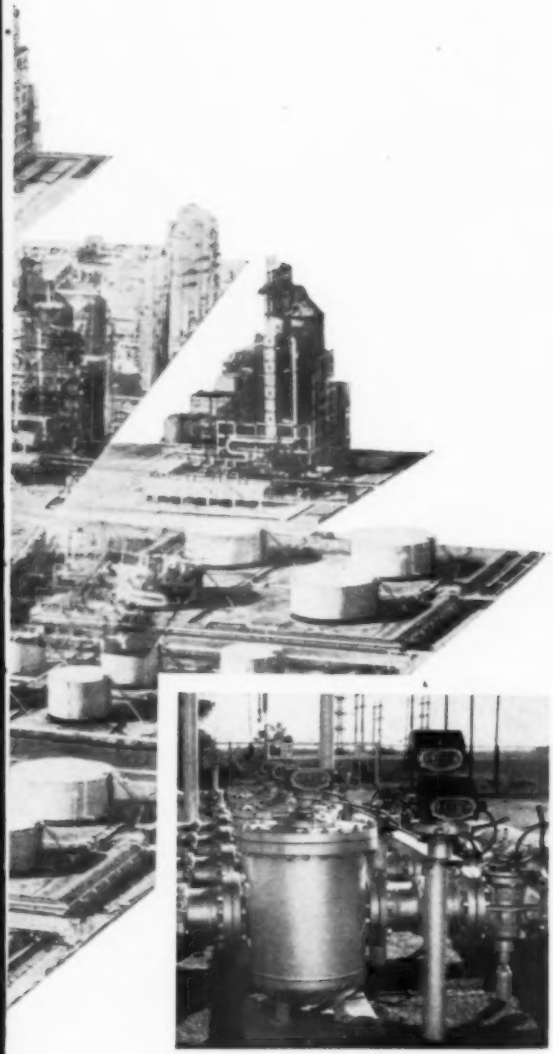
ADVERTISED PRODUCTS, SEE READER SERVICE CARD

meter systems"-

newest way to refinery expansion without buying real estate



With individual capacities ranging up to 2000 bph, these four A. O. Smith B-200 meters receive crude from a 16-inch line. Meters are connected by combinator units that register total throughout on counter-shifter ticket printer (foreground).

The road to expansion of refining facilities is frequently strewn with barriers — local zoning restrictions, expensive real estate or lack of available adjoining land.

To avert these drawbacks, more and more major pipeliners and refiners are turning to A. O. Smith engineered meter installations. Large volume A. O. Smith meters release measurement tankage for storage purposes . . . provide faster, less complicated throughput . . . reduce overall capital investment . . . slash tank filling and breathing losses.

Equally important, A. O. Smith engineered meter systems provide exceptionally accurate measurement of all transactions.

Before you plan tank-farm expansion you'll be money ahead to consult A. O. Smith. There are meters and accessories for every receiving line — crude, LPG or natural gasoline . . . models for a wide range of operating pressures. And, A. O. Smith meters are equally accurate in measuring finished petroleum products . . . offer similar space saving advantages. Contact your man from A. O. Smith today or write direct:

Through research A.O. Smith *. . . a better way*

A.O.Smith
CORPORATION

METER, SERVICE STATION PUMP, DIVISIONS

Factories: 5715 Smithway St., Los Angeles 22, Calif.; P. O. Box 500, Succasunna, N. J. Offices: Atlanta 5, Ga.; Chicago 3, Ill.; Houston 2, Texas; Los Angeles 22, Calif.; New York 17, N. Y. Canada: Toronto 12, Vancouver 1.
A. O. Smith INTERNATIONAL S.A., Milwaukee 1, Wisconsin, U. S. A.

Foxboro Capacity Dynalog* Recorder, located upstream from receiving station, records dielectric constant of pipeline product — telemeters it ahead to delivery point.

New Accuracy in Interface Detection!

Unique Foxboro System profiles interface in advance — helps reduce product contamination at switch-over

Now your pipeline dispatchers can accurately chart the shape of an interface in advance — pinpoint their switch-over of product runs!

The Foxboro Pipeline Interface Detection System is based on the fact that even slight differences in grades of petroleum products have measurably different dielectric constants. Sensitive capacity Dynalog* Recorders measure this difference, both at the pipeline delivery station, and at a point one or two miles upstream. Foxboro Teletax* Telemetering brings the two measurements together on a single chart at the delivery station.

From the shape of the upstream record, the dispatcher selects the best cut point well before the interface arrives, and sets index at this point. When station interface record matches index, switch-over is made.

Foxboro Interface Detection eliminates sampling and guesswork — holds product contamination and loss to a new minimum. Systems in use today include both dual-measurement and single-measurement systems. Ask your nearby Foxboro Field Engineer about them, or write for Bulletin 20-11. **The Foxboro Company, 382 Norfolk St., Foxboro, Massachusetts.**

*Reg. U.S. Pat. Off.

2-pen Capacity Dynalog Recorder, at delivery station. One pen records dielectric interface measurement telemetered from upstream station. Second pen records measurement at delivery station. From upstream record, dispatcher selects best cut point, and aligns index with this point on chart. When second pen matches index, switch-over takes place, either automatically or manually.

FOXBORO
REG. U.S. PAT. OFF.

INTERFACE DETECTION SYSTEMS

Ability to BUILD!

. . . progress powered by engineering know-how

CRUSHING FORCE of earth-moving monsters, curves in a complex feasibility study, coursing of chemicals in a new process — these are elements of engineering know-how.

Men of the Fish Companies combine idea freshness and system to create reality from ideas. If design is a problem . . . if time and topography oppose, the know-how of engineering by Fish drills to the heart of the problem in the oil, gas and chemical industries.

Fish builds in all dimensions everywhere.

THE FISH ENGINEERING CORPORATION
HOUSTON
AND ASSOCIATED COMPANIES

FISH SERVICE CORPORATION • FISH NORTHWEST CONSTRUCTORS, INC.

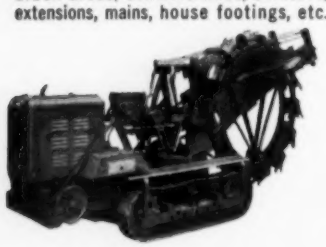
FOR FURTHER INFORMATION ON ADVERTISED PRODUCTS, SEE READER SERVICE CARD

Announcing 3 GREAT NEW

The J-20

Width over crawlers ..... 4′ 10″
Crawler length, C.C. ..... 6′ 3″
Overall length .....21′ 6″
Width of crawler shoe ..... 10″
Weight ..... approx. 13,500 lbs.
Ground bearing pressure ..... 8.8 psi.
Cuts trench 13″ to 24″ wide, to 5′ 6″ deep

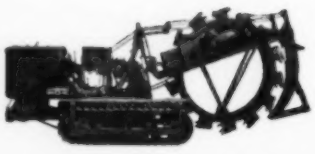
Principal applications:
urban areas, utilities lines, services, extensions, mains, house footings, etc.



The J-30

Width over crawlers ..... 6′
Crawler length, C.C. ..... 6′ 9″
Overall length .....22′
Width of crawler shoe ..... 14″
Weight ..... approx. 15,000 lbs.
Ground bearing pressure ..... 6.5 psi.
Cuts trench 13″ to 24″ wide, to 5′ 6″ deep

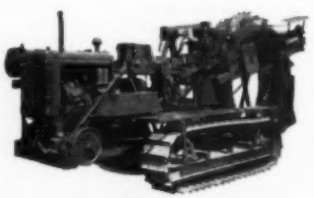
Principal applications:
suburban areas, drainage, utilities, gathering lines, footings, septic tanks, leach beds.



The J-40

Width over crawlers ..... 8′
Crawler length, C.C. ..... 7′ 6″
Overall length .....23′
Width of crawler shoe ..... 18″
Weight ..... approx. 18,800 lbs.
Ground bearing pressure ..... 5.6 psi.
Cuts trench 17½″ to 30″ wide, to 5′ 6″ deep

Principal applications: trench up to 30″ wide —pipelines, waterlines, drainage, irrigation, sewer lines, utilities.



...with the basic Cleveland characteristic ... *Quality*

CLEVELAND TRENCHERS

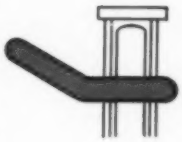
with ...revolutionary new V conveyor

...world's finest trencher crawlers

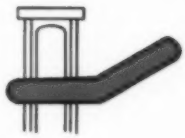
...all operations controlled at operator's seat

V CONVEYOR ... provides maximum clearance under digging wheel rims ...allows higher heaped loads without clogging ... provides constant elevating angle for faster, higher spoil discharge ... reduces rolling and tumbling ... has stronger torsion-free construction ... employs huskier, longer-lived bearings.

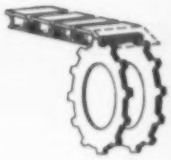
AUTOMATIC CONVEYOR SHIFT ... operator controls hydraulic shifting and positioning of conveyor ... digs past poles, trees, shrubs ... places spoil where needed ... *all* without leaving seat, without interrupting other operations.



DUAL INDEPENDENT CONVEYOR DRIVE ... identical, self-contained hydraulic motor and planetary gear drives in each head-pulley eliminate *all* conveyor chains and sprockets ... reduce belt slippage and wear ... furnish operator fingertip control of conveyor belt direction and speed (215-1,000 fpm) independent of all other operations.



FINEST CRAWLERS ON ANY TRENCHER ... employ double flanged wheels, rollers and sprockets with wide-spaced teeth ... drives on each end of 1½" dia. hardened pins ... completely eliminates pockets for dirt, stones, etc. ... eliminates take-up devices ... gives greater track stability ... lengthens wear life ... sprockets, wheels and idlers ride on sealed ball or roller bearings requiring only 200-hour lubrication ... a tremendously long-lived, trouble-free, easy-rolling crawler track.



BIG 16"x3" HYDRAULIC STEERING BRAKES ... controlled by suspended-type foot-pedals ... provide simple easy steering and maneuvering.

HYDRAULIC CRUMBING SHOE ... now, crumbing shoe advantages (cleaning, grading) are practical even in crowded digging ... Cleveland's hydraulic shoe control (optional, extra) pivots shoe back and up to allow setting wheel to required depth at walks, drives, underground obstructions, etc.

Engine, Hoist, Wheel, Shoe, Conveyor Speed—Direction—Shift, Crawlers

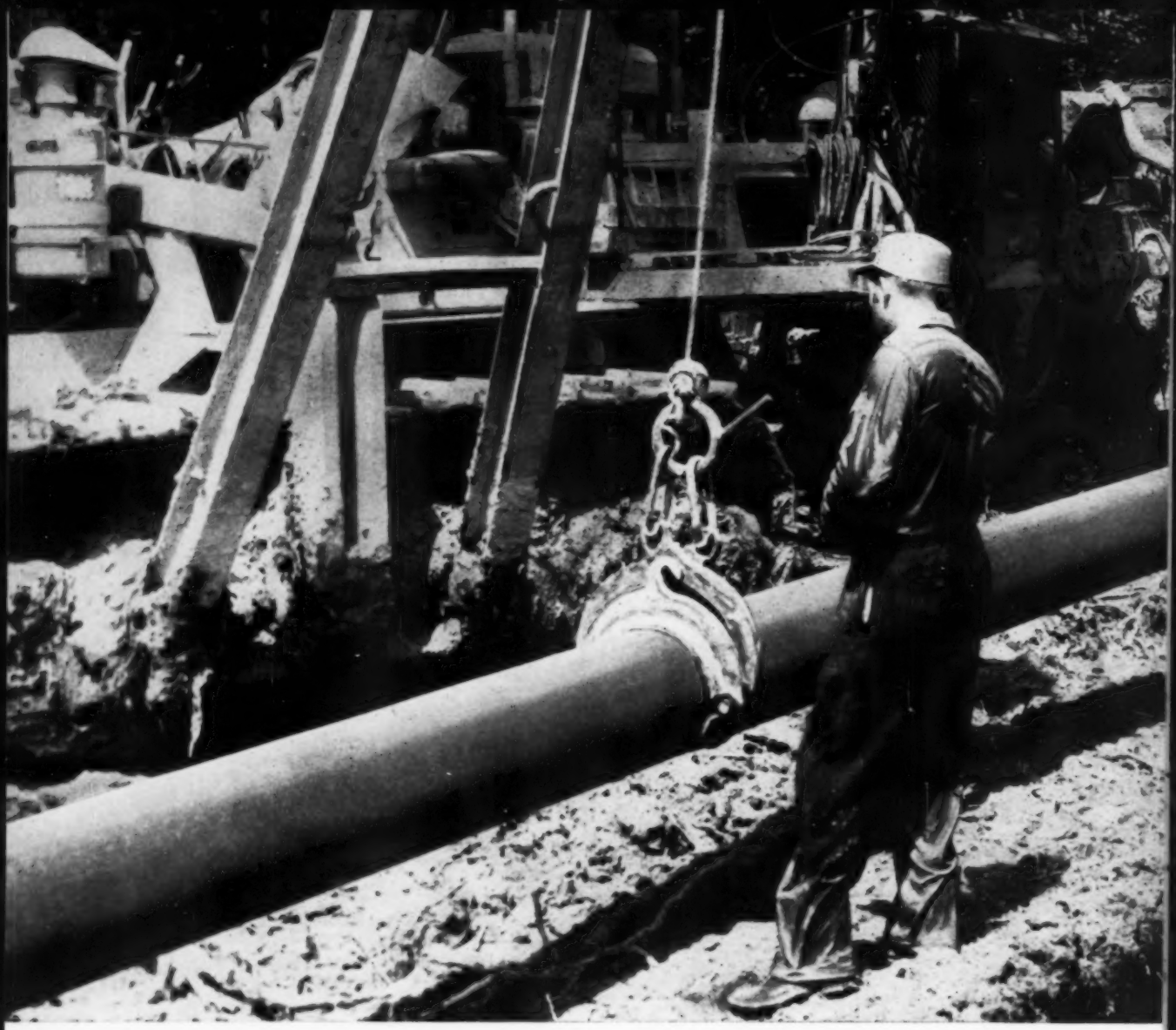
...Every Operation Controlled at Operator's Seat.

Good Everywhere

The CLEVELAND TRENCHER Co.

Pioneers of the Modern Trencher

20100 St. Clair Avenue
Cleveland 17, Ohio



BETHLEHEM LINE PIPE

now produced to 42 in.

It's Bethlehem Steel Line Pipe for many reasons: for top quality in materials and manufacture; for top uniformity in size, surface, and wall; for top performance in every type of installation. At our Steelton, Pa., plant we have new facilities for cold-expanding electric fusion-weld pipe *to 42 in. OD.* And on our new mill at Sparrows Point, Md., we produce electric resistance-weld pipe from $5\frac{9}{16}$ in. to 16 in. OD *in lengths to 60 ft.*

For top economy in every phase of pipe line construction and operation, use Bethlehem Steel Line Pipe. Let our nearest sales office quote on your requirements.

	SIZES (in., OD)	WALL THICKNESSES (in.)	LENGTHS	SPECIFICATIONS
HYDRAULICALLY EXPANDED ELECTRIC FUSION-WELD (submerged arc)	22 and 24 26 through 36 36 through 42	¼ to .438 incl. ¼ to ⅝ incl. ¼ to ¾ incl.	40-ft ①	API 5LX, Grades X42, X46, X52 & X56
ELECTRIC RESISTANCE-WELD	5 (nom) to 16	API	to 60-ft	API 5L, Grades A & B API 5LX, Grades X42 & X46
CONTINUOUS BUTT-WELD	½ to 4 (nom)	API	SRL 24 to 26-ft DRL to 50-ft	API 5L
COMPRESSOR STATION PIPE in diameters, thicknesses, and lengths as required.				
① Expanded after two 20-ft lengths are joined with girth weld.				

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

NEW, EXCLUSIVE DESIGN SUITS EVERY PIPELINE CONDITION TO A "T"

IT'S THE WmSON TYPE **T** PIG

New TRIANGLE design brushes* for more efficient and economical cleaning of all pipelines — *U. S. Pat. Pending

SEE OUR EXHIBIT

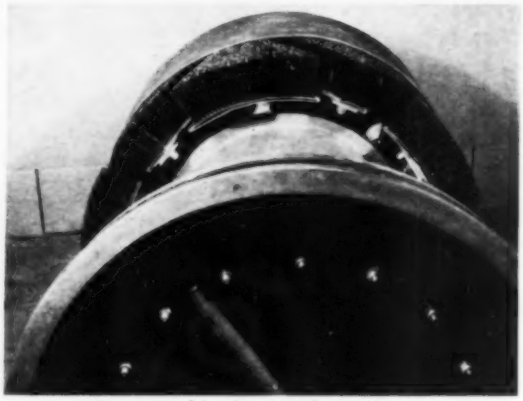
International Petroleum Exposition

MAY 14-23. 1959
Tulsa, Oklahoma

Williamson engineering has developed a new concept in pipeline pig design. This rugged, streamlined pig which is already widely used in gas, products and oil lines is available in sizes 12" and larger. Various engineered designs are available for traversing Gate Valves, Check Valves, Side Openings, Welding Ells, Miter Bends, etc.

- **EFFICIENT** — Exclusive triangle brush for full pipe coverage. (see photo at right)
- **LONGER LIFE** — Greater spring movement for increased cleaning life.
- **ECONOMICAL** — Increased mileage and ease of handling.

There's a "T" Pig Design for your pipeline . . . consult factory for specific recommendations.



Rear view of brushes partially inside pipe.

T. D. Williamson, Inc.

P. O. BOX 40 TULSA 2, OKLAHOMA

REPRESENTATIVES: HOUSTON • AMARILLO • PITTSBURGH • JOLIET, ILL. • LONG BEACH • SAN FRANCISCO • BARTLESVILLE, OKLA. • SEATTLE • SALT LAKE CITY • WEST MONROE, LA. • COLUMBUS, OHIO • EDMONTON • TORONTO • VANCOUVER • BUENOS AIRES • MONTERREY AND MEXICO CITY • CABIMAS, ZULIA, VENEZUELA • DURBAN, NATAL, S. AFRICA • PARIS • SYDNEY, AUSTRALIA • ROME, ITALY • MADRID, SPAIN • FRANKFURT MAIN, GERMANY

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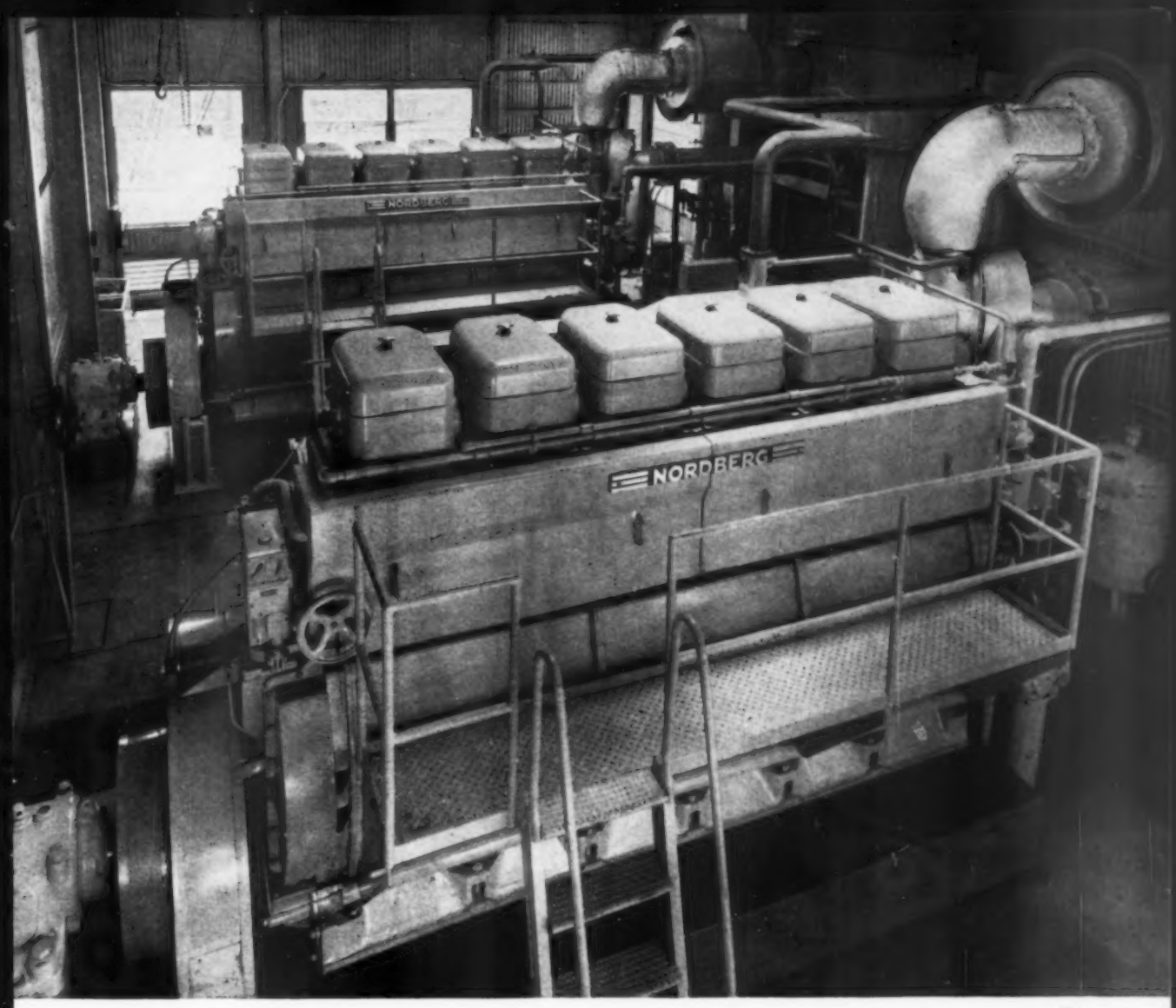
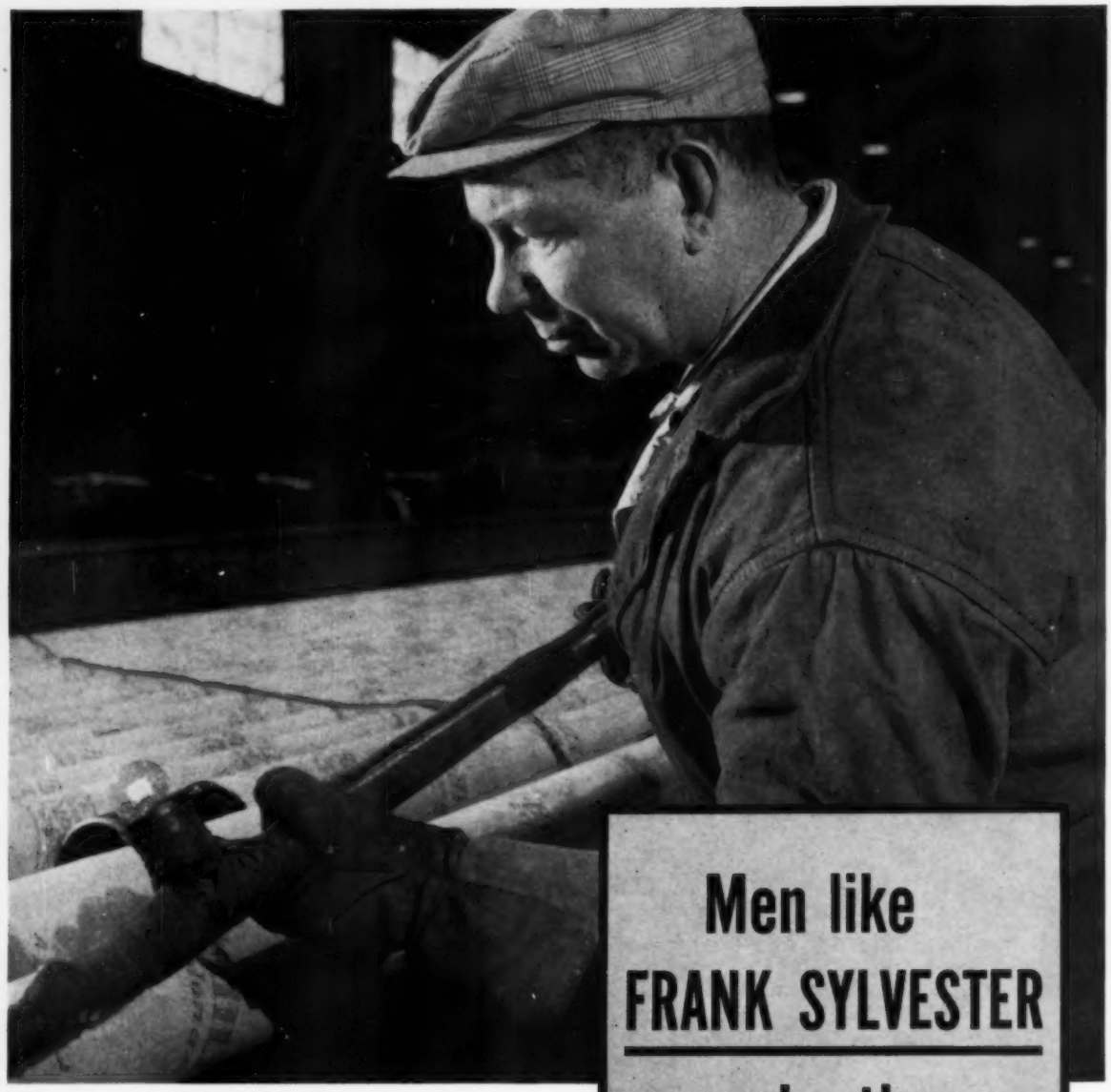


Pipe line engines by Nordberg

Remote control, unattended operation of four turbocharged Duafuel® Nordberg engine-pumping units in two stations on a crude line operated by The Texas Pipe Line Company.

NORDBERG MANUFACTURING COMPANY
MILWAUKEE 1, WISCONSIN

ATLANTA • CLEVELAND • DALLAS • DULUTH • HOUSTON • KANSAS CITY • MINNEAPOLIS
NEW ORLEANS • NEW YORK • ST. LOUIS • SAN FRANCISCO • TAMPA
WASHINGTON • TORONTO • VANCOUVER • JOHANNESBURG • LONDON • MEXICO D. F.



Men like FRANK SYLVESTER make the difference!

Pipe has to "go straight" when Frank Sylvester's around. You see, Frank's an expert in the use of this electronic "lie detector" which checks every inch of pipe for any possible imperfection. Frank is one of the hundreds of Hill-Hubbell trained craftsmen who make doubly sure you get an honest job when you specify Hill-Hubbell.

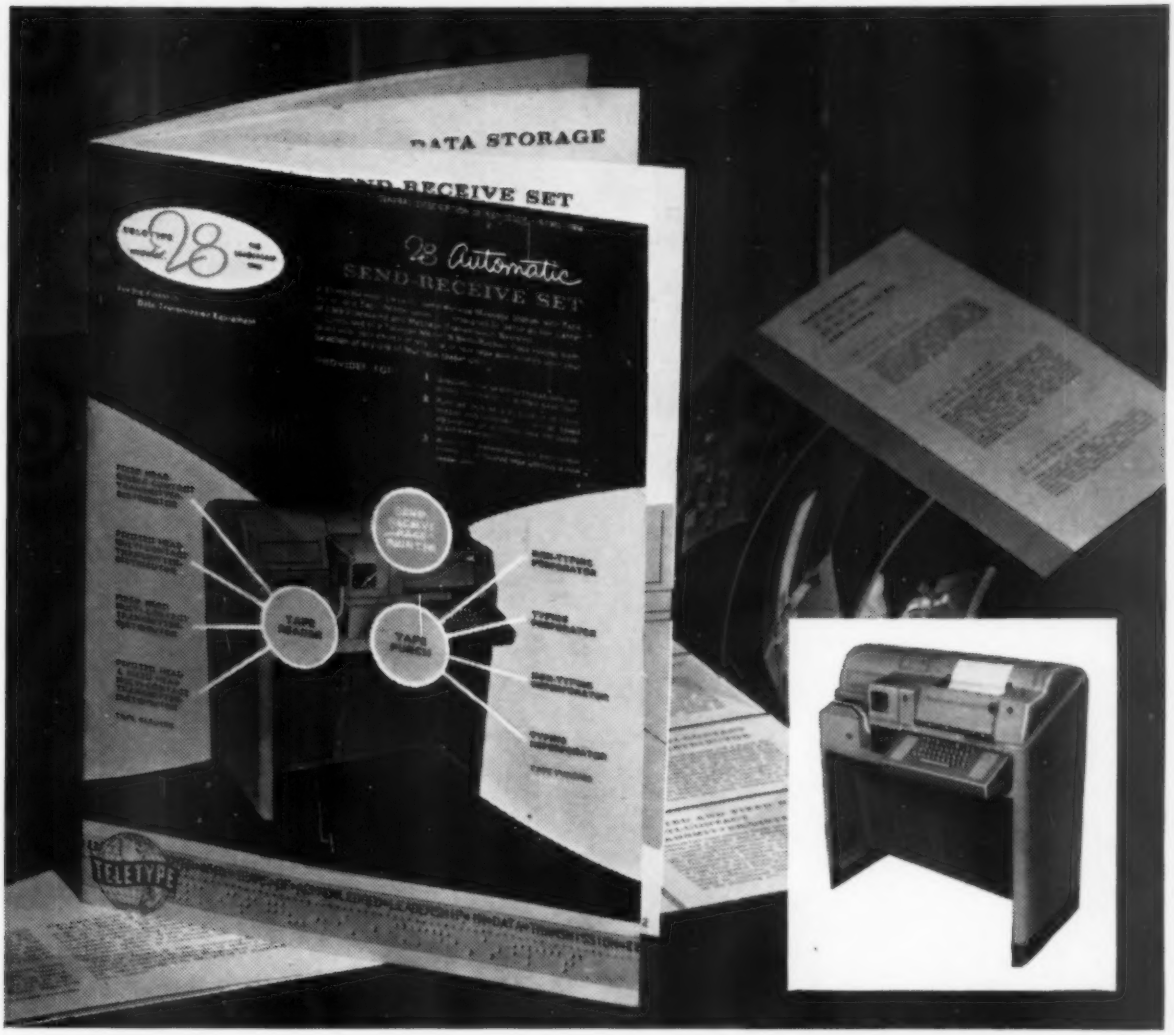
For every pipe protection job, demand the precision of factory application and factory-control... be sure you get the best!

Specify Hill-Hubbell wrapped pipe on your next job

HILL-HUBBELL & COMPANY

DIVISION OF GENERAL PAINT CORP. • 3091 MAYFIELD ROAD, CLEVELAND 18, OHIO

FACTORY APPLICATORS OF COATINGS AND WRAPPINGS



FREE– Teletype booklet ...details new 28 ASR

Contents—Includes information on:

- Automatic communications
- New transmission speed
- Tape punching
- Tape reading
- By-product tapes
- Printing on tape
- Printing on forms
- Data processing
- Data transmission
- Data storage
- Aids to IDP
- "Robot brain"
- Reducing "clerical lag"
- Etc.

This 16-page booklet describes the new Teletype Model 28 Automatic Send-Receive Set.

The Model 28 ASR is a "packaged" set—a single, compact console with a complete array of facilities—to serve as a center for your communication, data processing, paperwork simplification and automation systems. Operates at 100 WPM.

Please write for your free booklet on company letterhead.

Address: Teletype Corporation, Dept. 90 B, 4100 Fullerton Avenue, Chicago 39, Illinois.

TELETYPE®
CORPORATION
SUBSIDIARY OF *Western Electric Company* INC.

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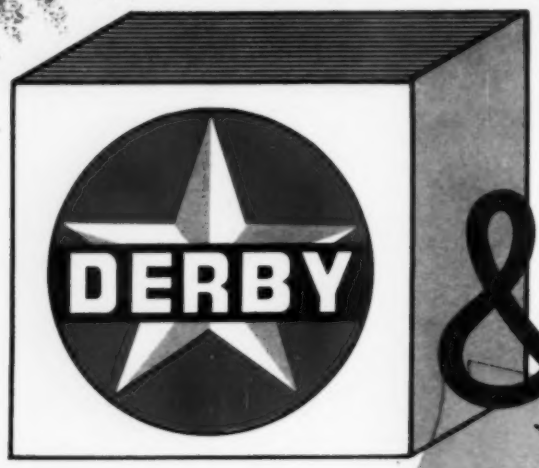

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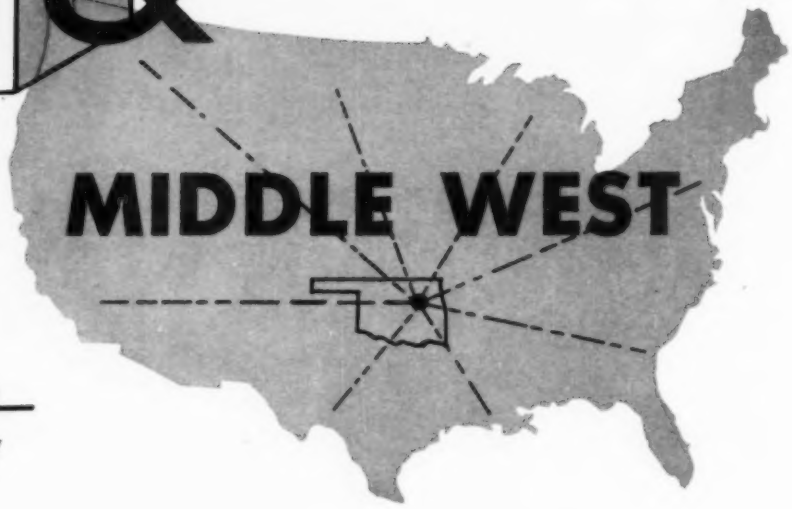


Present

DERBY LION E-120® COATING

for Positive and Lasting Pipe Line Protection

Middle West Coating and Supply, pioneer specialists in pipeline protection products, has been appointed distributor for Derby Lion E-120 Coating, as manufactured by the Derby Refining Company,* Wichita, Kansas. You are cordially invited to use the technical service personnel of Middle West in solving your pipeline corrosion prevention problems.

Under license from Lion Oil Company

INVESTIGATE DERBY LION E-120® COATING

- More economical than most hot-applied products
- A blend of asphaltic resins and hydrocarbons combined with a high grade (425 mesh) filler
- Low moisture absorption
- High electrical resistance
- Strong mechanical properties
- Firm, tough, flexible film withstands pipe handling
- Low weight provides tonnage savings, lower freight and handling charges
- Shipped in 120-pound cardboard cartons
- Prices also furnished, applied, by Pipe Coating Applicators

For additional information, call, wire or write

MIDDLE WEST COATING and SUPPLY

LUther 2-5215 — P. O. Box #153
Tulsa, Oklahoma

WITH THE PIPELINE CONTRACTORS

● **APV Company, Inc., Continental National Bank Building, Fort Worth, Texas.** Has contract to install a triple pipeline crossing under the San Juan River, including two 34-in. lines and one 6-in. line located on the Navajo Indian Reservation in the Four Corners area of New Mexico, for *El Paso Natural Gas Company*.

● **Ashy Construction Company, Inc., P. O. Box 472, Eunice, Louisiana.** Has a contract from *Transcontinental Gas Pipe Line Corporation* to install 63 miles of 6, 8, and 10-in. pipeline.

● **B & M Construction Corporation, 2808 First National Bank Building, Oklahoma City, Oklahoma.** Has been awarded a contract to build 218 miles of 8-in. line for *National Iranian Oil Company* from Tehran to Resnt, Iran.

● **Brown & Root, Inc., 4100 Clinton Drive, Houston, Texas.** Has contract with *Texas Eastern Transmission Corporation* to furnish field supervision for construction of 626 miles of 30-in. loops along the company's line between Beaumont, Texas, and Uniontown, Pennsylvania.

● **O. R. Burden Construction Corporation, P. O. Box 5216, Tulsa, Oklahoma.** Constructing gathering system in Jack and Wise counties, Texas, for *Natural Gas Pipeline Company of America* to connect 84 new wells.

● **Collins Submarine Pipelines, Ltd., London, England. (Collins Construction Company, P. O. Box 86, Port Lavaca, Texas.)** Has been awarded a contract by the *British Atomic Energy Authority* to install 12,000 ft of 6-in. pipeline at the shore at Winfritheath, England, (near Lulworth), to a depth of 80 ft, in the English Channel.

● **Delta Engineering Corporation, P. O. Box 13256, Houston 19, Texas.** To build pump stations at Main Pass, Southwest Pass, Ostrica and Pilottown in southern Louisiana for *Shell Pipe Line Corporation's* Delta crude oil pipeline.

● **Engineers Limited Pipeline Company, 225 Bush Street, San Francisco 4, California.** Has 102 miles of gathering lines in Aneth field, Utah, for *El Paso Natural Gas Company*.

● **C. N. Flagg & Company, Inc., 48 Elm Street, Meriden, Connecticut.** Has been awarded a contract by *North Carolina Natural Gas Corporation* to lay 102 miles of 3 to 6-in. pipeline.

● **R. H Fulton & Company, Box 1526, Lubbock, Texas.** Has 21 miles of 26-in. from Fritch, Texas, northward, and 205 miles of 36-in. to a point near Meade, Kansas, for *Natural Gas Pipeline Company of America*, and will also build segments of the line from Offerle to Lincoln, Kansas. Also has contract to build 117 miles of 20-in. gas line and 58 miles of gas gathering system in the West Texas area for *El Paso Natural Gas Company*.

● **Glaser Construction Company, Inc., P. O. Drawer 1387, Oil Center Station, Lafayette, Louisiana.** Has contract to lay about 50 miles of 8, 12, and 16-in. pipe for Shell *Pipe Line Corporation's* Delta crude oil pipeline in southern Louisiana.

● **B. C. Hall Constructors, Inc., P. O. Box 644, Aztec, New Mexico.** Has contract to build an undetermined amount of various sizes of pipelines ranging from 4-in. through 20-in. for *El Paso Natural Gas Company* in the Four Corners area of New Mexico.

● **Hallmac Construction Company, 3701 Buffalo Drive, Houston, Texas.** Has been awarded a contract by *United Gas Pipe Line Company* to install 43 miles of 30-in. pipeline from Mandeville, Louisiana, to Kiln, Mississippi.

● **Harbert Construction Corporation, P. O. Box 1369, Birmingham, Alabama.** Has nearly 500 miles of 18-in. and 20-in. main gas lines and more than 600 miles of 4-in. through 16-in. lateral lines under contract with *Houston Texas Gas and Oil Corporation* from Bradenton, Florida, to Miami, Florida.

● **A. C. Holder Construction Company, Inc., 2410 North Lewis, Tulsa, Oklahoma.** Has been awarded a contract by *Mid-States Pipe & Supply Company* to take up 36 miles of 12-in. pipe and 60 miles of 8-in. between Griffith, Indiana, and Manhattan, Illinois.

● **Houston Contracting Company, 2807 Buffalo Speedway, Houston 6, Texas.** Has 62 miles of 20-in. crude line for *Shell Pipe Line Corporation* from the vicinity of Nairn, Louisiana, north to Norco refinery above New Orleans.

● **Hunsaker Trucking Contractor, Inc., P. O. Box 97, Carrollton, Texas.** Has contract to unload, stack and string 104 miles of 24-in. pipeline from Smith Point, Texas, to north of Sulphur, Louisiana, for *Coastal Transmission Company*.

● **International Marine Constructors, C. A., Caracas, Venezuela. (Collins Construction Company, P. O. Box 86, Port Lavaca, Texas.)** Has been awarded a contract by the Iranian Oil Company to lay 25 miles of 30-in. at Ganaweh, on the Iranian shore, to Kharg Island, approximately 25 miles out in the Persian Gulf.

● **Majestic Contractors, Ltd., 408 Royal Trust Building, Edmonton, Alberta, Canada.** Has an undetermined amount of gas gathering system for *Producers Pipeline Company* in the Estevan, Saskatchewan, area.

● **J. Ray McDermott, Inc., P. O. Box 38, Harvey, Louisiana.** To install major crossings of the Mississippi at Nairn and Destrehan, Louisiana, as well as three other water crossings, for *Shell Pipe Line Corporation's* Delta crude oil pipeline in southern Louisiana, which will move crude to Shell Oil Company's Norco, Louisiana, refinery 18 miles west of New Orleans from terminals on the southwest and southeast tips of the Mississippi River delta.

● **McVean and Barlow, Inc., P. O. Box 151, Odessa, Texas.** Has a contract to build 116 miles of 20-in. pipeline for *El Paso Natural Gas Company* in West Texas and Eastern New Mexico.

● **Mid-States Construction Company, P. O. Box 417, Mt. Vernon, Illinois.** Has been awarded approximately 150 miles of 3½-in. to 16-in. pipeline by Harbert Construction Corporation, prime contractor for *Houston Texas Gas and Oil Corporation* in Florida.

● **Midwestern-Welco Contractors, P. O. Box 11507, 1431 4th Street South, St. Petersburg 33, Florida.** Has been awarded a contract by *Houston Texas Gas & Oil Corporation* to lay approximately 700 miles of 24-in. main line between Baton Rouge, Louisiana, and Kissimmee, Florida, including a 24-in. crossing of the Choctawhatchee River at Caryville, Florida, and an 18-in. crossing of the Mobile River at Mt. Vernon, Alabama, and three compressor stations at Wiggins, Mississippi; Munson, Florida; and Quincy, Florida.

● **J. P. Neill & Company, Inc., 1200 Exchange Bank Building, Dallas 35, Texas.** Has been awarded 112 miles of 16-in. pipeline by *North Carolina Natural Gas Corporation*.

● **Oklahoma Contracting Company, P. O. Box 13227, Dallas 20, Texas.** Has contract for 130 miles of 24-in. between Lake Charles, Louisiana, and Baton Rouge, and 150 miles of 20-in. from Robstown to Bay City, Texas, for *Coastal Transmission Corporation*. Laying 100 miles of 30-in. for *Creole Petroleum Corporation* between Temblador and Caripito, Venezuela. Has 96 miles of 30-in. from Columbus, Mississippi, to the Tennessee River for *Tennessee Gas Transmission Company*.

● **H. C. Price Co., Price Tower, Bartlesville, Oklahoma.** Has 121.6 miles of 20 and 24-in. for *Southern Natural Gas Company* in Alabama, Mississippi, and Georgia. Approximately 65 miles of 24-in. in Louisiana for *Transcontinental Gas Pipe Line Corporation*.

● **River Construction Corporation, P. O. Box 9127, Fort Worth 7, Texas.** Has contract to lay approximately 125 miles of 24 and 26-in. line in Mississippi for *Southern Natural Gas Company*. Also has been awarded a contract by *Coastal Transmission Corporation* to build 104 miles of 24-in. pipeline from a point near Sulphur, Louisiana, to Smith Point, Texas.

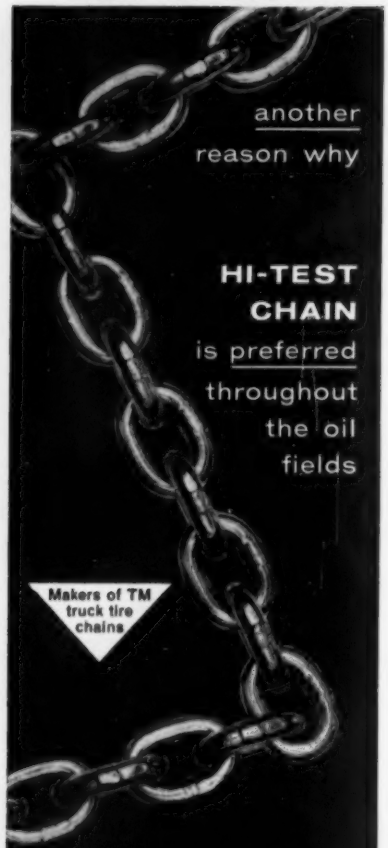
● **Somerville Construction Company, 6648 Fulton Road, Ada, Michigan.** Has a contract for 103 miles of 10-in. through 12-in. transmission lines from Pembroke to Goldsboro, North Carolina, and 60 miles of 3 and 4-in. lateral lines off these transmission lines for *North Carolina Natural Gas Corporation*.

● **Station Construction Company, 2807 Buffalo Speedway, Houston 19, Texas.** Has contract to build Norco terminal and Loutre Junction facilities in southern Louisiana for *Shell Pipe Line Corporation's* Delta crude oil pipeline.

● **Western Pipe Line, Inc., P. O. Box 1076, Austin, Texas.** Laying 112 miles of 24-in. and various size pipe in southern Louisiana for *Southern Natural Gas Company*.

● **Williams Brothers Company, National Bank of Tulsa Bldg., Tulsa, Oklahoma.** Has contract to build segments of a *Natural Gas Pipeline Company of America* line, consisting of 185 miles of 36-in. in Nebraska and Kansas, and 98 miles of 34-in. in Iowa.

TOUGHER STRONGER SAFER



TM Hi-Test Chain is made from high-tensile steel and heat-treated. It is tougher, stronger, safer than low carbon steel chain—more resistant to bending, gouging, abrasion, too. Short links provide maximum flexibility—better grips. Try it and see the big difference! Call your supply store or write for Oil Field Bulletin.

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PIPELINE PERSONALS

▸ **J. D. McConnell,** vice president and director in charge of crude lines for Sinclair Pipe Line Company, has been appointed to the position of vice president and director in charge of the company's newly created economics and planning department to handle the planning, economic analysis, and operating evaluation of projects in all phases of the company's pipeline operations. **Lewis B. Moon,** vice president in charge of products lines, has been named to supervise the company's crude oil and refined products pipeline networks, which have been consolidated.

J. D. McConnell

Lewis B. Moon

J. A. Jackman, executive assistant, was named to assist McConnell in the management of the newly formed economics and planning department. Moon will be directly assisted in the administration and supervision of the consolidated operations by **L. C. Foy** and **G. H. Giles,** general managers.

Field operations in the new setup will be supervised by the company's division managers: **J. E. Lewis,** Fort Worth, Texas; **T. A. Myers,** and **J. D. Maxey,** Independence, Kansas; **E. B. Jordan,** Marion, Ohio, and **C. R. Parish,** Casper, Wyoming.

▸ **John B. Tweedy** has been elected a vice president of Southern Natural Gas Company. Tweedy now is assistant to the chairman of the board of directors and a director of The Offshore Company, a subsidiary of Southern Natural Gas Company. Until taking his present office he was assistant to the chairman of the board of Southern Natural.

▸ **Harry McNeely** and **John L. Holder** have been promoted to superintendent and assistant superintendent, respectively, of New York State Natural Gas Corporation's Mamont district. McNeely formerly was assistant superintendent of the Mamont district, and Holder was foreman in the Sabinsville, Pennsylvania, district.

▸ **E. C. Hurd** has been appointed vice president of Trans Mountain Oil Pipe Line Company and its subsidiaries, according to an announcement by **D. M. Morrison,** president. Hurd, prior to the appointment, was administration manager.

▸ **John D. Stone,** corrosion engineer for Sunray Mid-Continent Oil Company, has been elected chairman of Teche Section, National Association of Corrosion Engineers. Other recently elected officers include: **Sam E. Fairchild,** Texas Pipe Line Company, vice chairman; **Ron J. Cernik,** Union Oil Company of California, secretary, and **Phil C. Brock,** Dowell, Inc., treasurer. **O. L. Bassham,** Tretolite Company, continues in office as trustee.

▸ **E. H. (Ed) Murphy,** Dallas, has been appointed special representative to the pipeline industry by Gardner-Denver Company. Murphy joined Gardner-Denver in 1928. He was in charge of a special sub-branch at Fort Williams, Ontario, Canada, last year during construction of the Trans-Canada pipeline. Murphy's headquarters will remain in Dallas, but he will work with contractors wherever pipelines are laid.

▸ **Thomas M. McQuilling** has been appointed general manager of American Oil Company's marine department, succeeding **Verne N. Drew** who is retiring.

▸ **J. W. (Bill) Carneal** has been elevated from his former position of assistant director of sales and customer relations for Texas Gas Transmission Corporation to director of sales and industrial development for the company. Carneal, in his new post, will broaden his activities in the sales and customer relations phase of the company's business and continue direction of the work he has done in the industrial field, providing plant site information in the eight-state area served by Texas Gas.

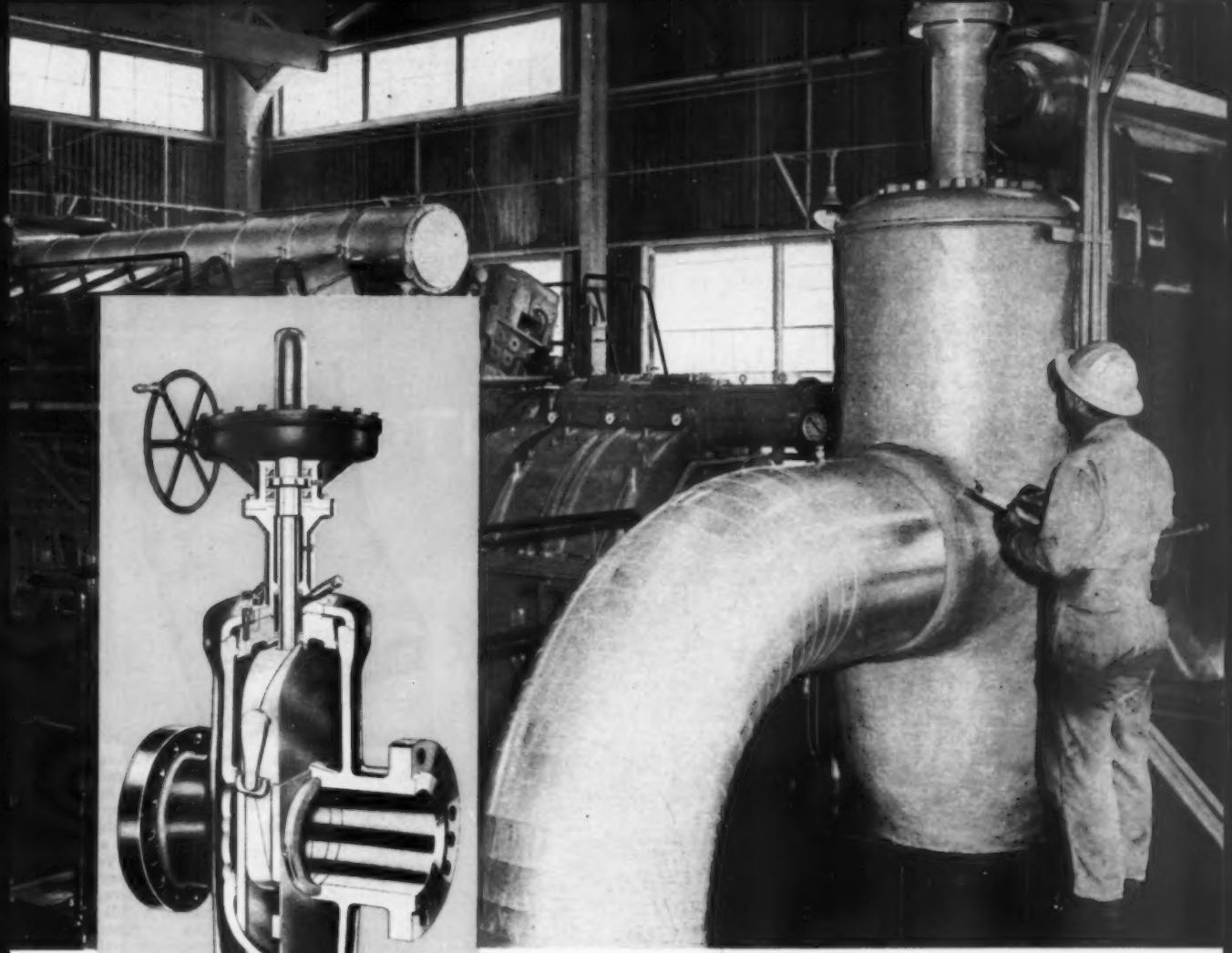
▸ **C. P. Hoffman** has been named by The Ohio Fuel Gas Company as assistant superintendent of gas measurement, succeeding **Michael P. Debaets,** who was recently named superintendent. **M. W. Doubikin** has been promoted to office manager, replacing Hoffman in that post.

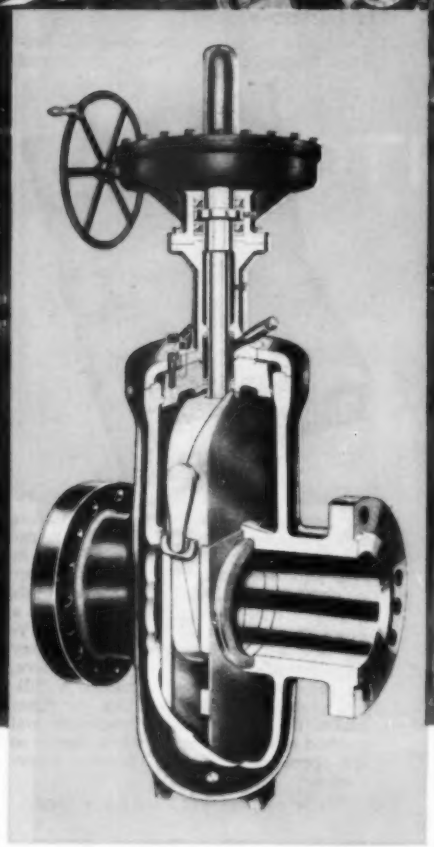
▸ **J. E. Thompson** has been appointed assistant chief engineer and **R. E. Evans** has been named general superintendent of construction for Natural Gas Pipeline Company of America. Thompson, who will assist **M. J. Paul,** has been superintendent of pipeline construction. Evans, compressor station construction superintendent, will head both departments.

▸ **George S. Patterson,** president of The Buckeye Pipe Line Company, has announced the appointment of **G. Frank Barnes** as administrative assistant to the president in the company's New York office. Barnes has been superintendent of Buckeye's subsidiaries, Northern Pipe Line Company and New York Transit Company, Inc.

▸ **Sam L. Jackson** has been appointed manager of operations in the supply and transportation department of Standard Oil Company (Indiana) succeeding **Richard E. Nelson, Jr.,** who was named earlier as president of the newly organized Amoco Trading Corporation, a Standard Oil Company affiliate. **Creed F. Gearhart,** formerly chief engineer, has been appointed to succeed Jackson, and **Lyle W. (Bill) Ewing, Jr.,** formerly superintendent of product movement in the supply and transportation department, has been named to succeed Gearhart. **James R. Polston,** formerly head engineer in the supply and transportation-operations engineering department, has been appointed superintendent of product movement in the supply and transportation department.

FOR FURTHER INFORMATION ON ADVERTISED PRODUCTS, SEE READER SERVICE CARD





W-K-M's *Creative Engineering*

sets the standards for pipeline valves around the world

From 2-inch to 34-inch, W-K-M's ASA gate valves have earned the commendation of pipeliners from California to Iran, from Peru to Canada.

And why not?

No other pipeline valves are so carefully engineered to meet the practical requirements of pipeline service. No other valves will give you the same performance, the same long life, the same long-range economy. No other valves can be so easily or quickly overhauled "on-the-line."

For complete dependability, specify W-K-M when you requisition valves.

The W-K-M® ASA Gate Valve can be overhauled "on-the-line"

W-K-M designed this valve to save you time and money. W-K-M valves give you longer service between overhauls, and when overhaul is necessary, you can do the job while the valve is *on-the-line*. This one feature saves users of W-K-M valves thousands of dollars each year.

Other features include: Full bore through-conduit; exclusive gate centralizing mechanism; freedom from destructive turbulence; no-surge operation; free passage for pigs or scrapers.

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DIVISION OF ACF INDUSTRIES
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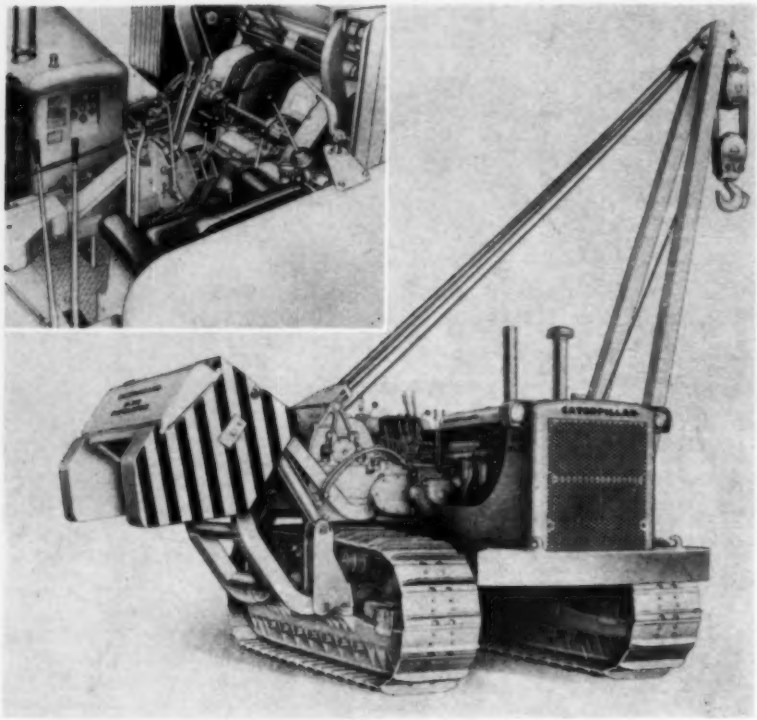
5613

It's New Pipeline Equipment

New Pipelayer Benefits Announced to Industry



To meet demands of today's increasingly rugged pipeline applications, the Caterpillar Series H No. 583 Pipelayer has been introduced. It weighs 83,840 lb, which is 5340 lb heavier than its predecessor; flywheel horsepower has been increased to 225, compared to the previous 191; lifting capacity, at 4-ft overhang, has been upped to 137,000 lb; and speed has been increased to 6.4 mph. Other major features are: Turbocharging by means of an exhaust-driven turbine; dry-type air cleaner; a new torque converter that has a torque multiplication of 4.00:1; hydraulically-actuated steering clutches; a hunting-tooth sprocket to provide longer sprocket life; "Lifetime Lubricated" rollers and idlers; floating-ring seals and rubber rings; and console-mounted primary pipelayer controls. Counterweight design incorporates a bottom pivot, rotating the counterweights upward and out from a second pivot point on the counterweight frame. *Caterpillar Tractor Company.*

Circle number (81) on reply card.

Gage Measures Levels And Water Interface

A new electronic tank gage dual operation feature has been announced — measurement of water interface, as well as product levels, with the same basic components. Suspended in the tank is a sensing element, a quarter length antenna, which just touches the product surface. Against a fixed or constant radio frequency signal transmitted to the antenna are balanced detected or variable signals. The sensing element follows product level as a result of signal imbalance. When a switch on the servo-control mechanism is operated, the sensing element moves below product level and continues sounding through the product until the surface of the water bottom is reached. *Gilbert & Barker Manufacturing Company.*

Circle number (82) on reply card.

Limited Input Welder

A new a-c machine is offered for the 1001 welding jobs that come within the range of 20 to 180 amp. It has 16 steps of heat, and a high open circuit of 65 v that permits the use of low hydrogen and stainless steel electrodes up to 3/16-in. Meets all NEMA and REA specifications. *Harnischfeger Corporation.*

Circle number (83) on reply card.

Soil Selection Simplified

A new instrument which simplifies 4-pin soil resistivity measurements for cathodic protection work has been announced. With convenient cable and pin set-up, a variety of soil resistivity measurements can be obtained merely by rotating a 6-position selector switch. *Rio Engineering Company.*

Circle number (84) on reply card.

Pneumatic Calibrator Is Portable

A truly portable instrument for precision calibration has been introduced

for field checking of pneumatic controls and instrumentation, particularly transmitters, recorders, and controllers in place, in the 3 to 15 psi range. Other ranges are available. The manufacturer's Precision Dial Manometer is secured to a shock mounted panel in a portable carrying case with pressure regulators, 3-way selector valve, overpressure-relief valve, air filter and connection block. A full-size graphic flow diagram on the panel makes the instrument's functions and method of connection quickly apparent to the operator. *Wallace & Tiernan Incorporated.*

Circle number (85) on reply card.

Improved Pipe Detector

Improved independent detection of closely parallel pipes by the Detectron

Pipe Detector, it has been announced, is the result of a newly designed circuit that provides a more stable field signal and reduces the possibility of false signals frequently caused by static and minor changes in the mineral content of the soil. Improvements are incorporated in both the standard model "505" and the "505-C" Combination Pipe-Leak Detector. *Computer-Measurements Corporation.*

Circle number (86) on reply card.

Lower Battery Drain—No need now for heavy duty batteries and generators. Current drain on "stand-by" is 1/3 that of tube-type receivers, 1/15 with battery saver switch.

Greater Reliability—Transistors, printed circuits and new design all greatly increase reliability.

Smaller, Lighter—Approximately 1/2 the weight, 1/3 the size of other models. Mounting in tight quarters easier than ever.

Completely transistorized receiver and power supply... Another Motorola First!

Here is 2-way radio with efficiency and reliability never before approached in mobile radio. No more tubes in the receiver —no more vibrators in the power supply . . . all are replaced by long life, dependable transistors. No longer is it necessary to idle the vehicle to keep the radio operating. Savings in gasoline, engine wear and batteries add up fast. Let us prove to you how MOTRAC radio will cut your radio operating costs . . . while giving you reliability never before possible. Write today.

MOTOROLA 2-WAY RADIO

Motorola Communications & Electronics, Inc. • A Subsidiary of Motorola Inc., 4501 Augusta Blvd., Chicago 51, Ill.

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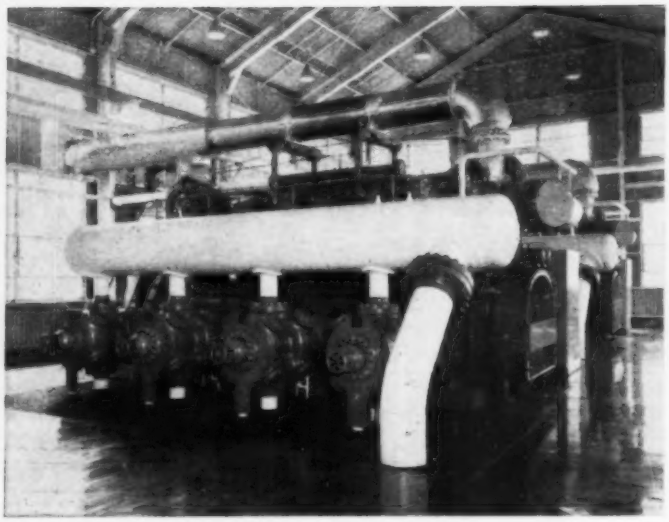
Behind this symbol

... a century of service

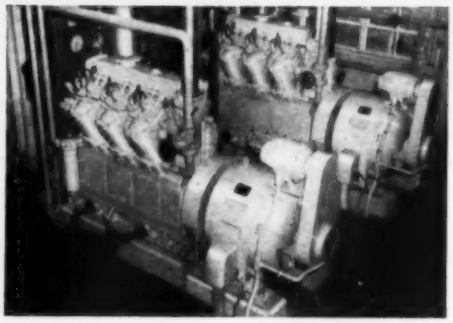
Here's what it means to

PIPELINE MEN...

Above are three Ingersoll-Rand Class RT centrifugal pipeline pumps in a Mid-western pumping station.



Above are two of five 2000-hp KVS turbocharged 4-cycle gas-engine compressors in a gas transmission station.



These two 220-hp PJVG gas-engine generating units provide a-c power for a gas transmission station.

At right, an I-R Dual-Drill Rig suspended from a tractor boom, powered by air from an I-R Gyro-Flo rotary portable compressor.

Ingersoll-Rand has the world's most comprehensive compressor experience, and builds heavy-duty reciprocating, centrifugal, rotary and jet types in all sizes. The I-R family of 4-cycle V-angle engine-compressors, ranging from 120 to 2000 hp and larger, is characterized by smooth operation and stability over a wide range of speeds and loads. Other reciprocating units are built from ½ to 7500 hp for any drive.

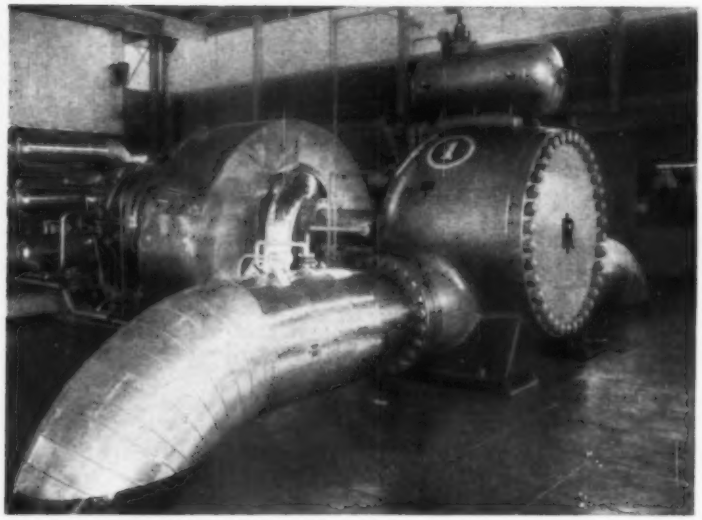
Heavy-duty 4-cycle, V-angle gas engines, built from 200 to 2000 hp and larger, are suitable for any prime mover application. The ultimate in standardization, similarity of operation and maintenance, and unified responsibility is possible when I-R engine-generating units are installed along with I-R engine-compressors.

I-R centrifugal pipeline compressors are the product of 28 years of experience in this specialized application. Ingersoll-Rand has pioneered in the development of centrifugal gas compressors for higher and higher pressures and capacities.

FOR FURTHER INFORMATION ON ADVERTISED PRODUCTS, SEE READER SERVICE CARD

to the oil industry:

Soon after Colonel Drake discovered oil at Titusville, the history of Ingersoll-Rand began with the manufacture of Cameron reciprocating steam pumps. A few years later, other I-R "ancestor" companies began building compressors and rock drills. Ever since that time Ingersoll-Rand has been growing with the oil and gas industries. Today I-R provides the widest range of compressors, pumps and other equipment for the production, transmission, and processing of oil and gas and their products—the I-R monogram is more than ever a symbol of leadership and progress.



Above is one of ten gas-turbine-driven I-R centrifugal compressors handling natural gas at 798 psi.

A complete line of centrifugal pumps, for service on products and crude oil pipelines, is made by Ingersoll-Rand. They are available for a wide range of capacities up to 3000 gpm and pressures up to 1200 psi in standard sizes, or designed and engineered to specifications for other applications.

Other I-R products for pipeline men include portable compressors and contractors' equipment, air and electric tools, starting-air compressors and cooling-water pumps. Your Ingersoll-Rand representative will be glad to give you more information.

Ingersoll-Rand

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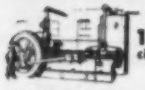
I-R MILESTONES OF PROGRESS
have had a far-reaching effect on the petroleum industry

1860 The first Cameron pump—a reciprocating steam pump which found wide use in the petroleum industry.

1871 Simon Ingersoll's steam-powered rock drill.



1872 Heavy-duty reciprocating compressors.

1902 The first portable compressor.

1906 The first direct-connected synchronous-motor-driven compressor.

1912 First centrifugal compressor for 90-psi air, and powered by I-R turbine.

1913 Centrifugal pump.

1920 Oil-engine compressor engineered as a unit; solid fuel injection.

1924 Large 4500-psi compressors for ammonia synthesis (still operating).

1927 Centrifugal pipeline pump; mechanical shaft seal.

1928 Barrel-type hot-oil charging pump for refineries.

1930 First compressor for 15,000 psi on commercial scale.

1931 Close-coupled Motorpump.

1931 First centrifugal gas pipeline compressor, "canned" with 3000-hp motor.

1933 Famous XVG gas-engine compressors combined multiple power cylinders and compressor cylinders on single frame.

1933 First non-lubricated compressors.

1935 Channel Valves set new standards for compressor valving, unmatched to this day.

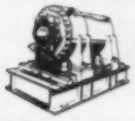
1937 Complete line of vertically-split centrifugal process pumps.

1940 First fluid cat-cracker main air blower.

1947 First high-pressure centrifugal compressor for gas transmission

1949 First centrifugal gas compressor for cat-cracking.

1952 First turbo-charged gas-engine compressor, the 2000-hp KVS.



1954 First centrifugal compressor for 2000 psi.

1955 Compressor built for 35,000 psi on commercial scale.

1958 Highest-pressure centrifugal pump—6500 psi.

In engineered products, there's no substitute for *experience*

New Aftercoolers For Air Compressors

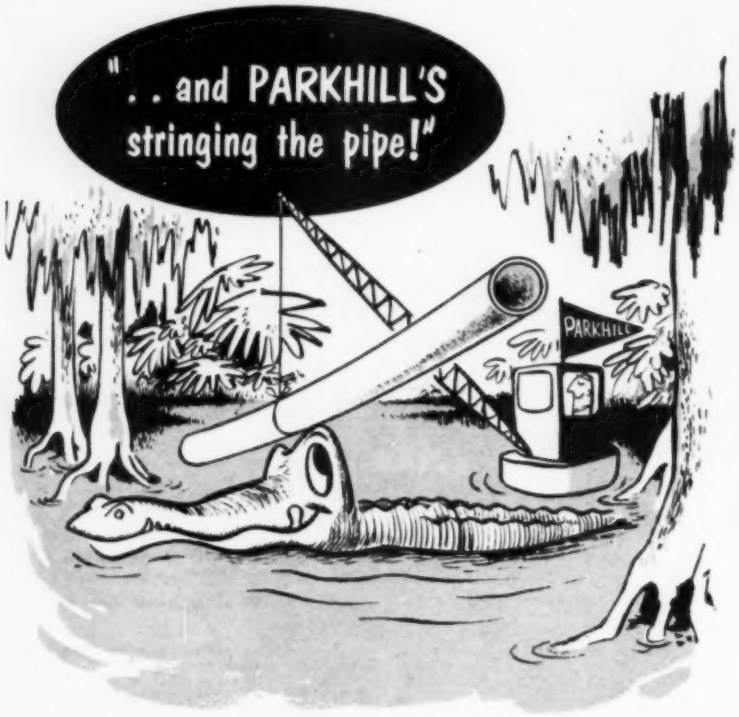
A new line of pipeline aftercoolers has been designed to cover the range of conditions encountered in air compressor service. The "counter current flow" design (air in tubes flowing counter to water in shell) permits the coldest (incoming) water to serve the coldest (outgoing) air. All sizes are rated for either 10 or 15 F temperature approach. The 54 models in this line have capacities specified for operating pressures up to 125 psig for single and two-stage compression. *American-Standard, Ross Heat Exchanger Division.*

Circle number (87) on reply card.

Pump Impeller Prevents Gas Binding, Prime Loss

The new "Vapor-flo" Motorpump, a petroleum handling centrifugal pump designed for flooded suction services where vortexing and vaporizing may develop, has a special impeller that eliminates gas binding and loss of prime. The pump's impeller passages diverge toward the periphery instead of converging so that liquid leaves the periphery faster than it enters the eye, forming a partial vacuum. Any gases or vapors present fill this vacuum and are conducted out of the pump with no interference in liquid flow. This pump is said to never clog or lose prime. *Ingersoll-Rand Company.*

Circle number (88) on reply card.



Anywhere . . . anytime!

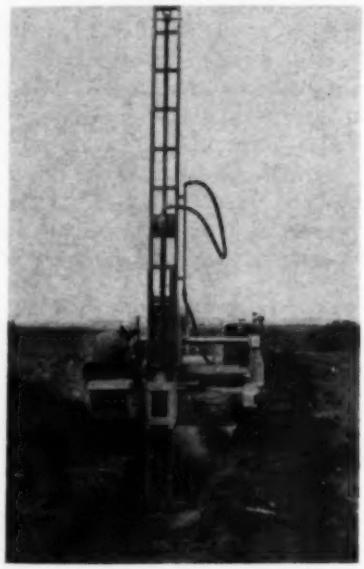
Parkhill has the men, the equipment and the experience to handle your next pipe stringing job, large or small. Give us a call and park your problems with Parkhill.

PARKHILL TRUCK COMPANY

POST OFFICE BOX 3807 • TULSA, OKLAHOMA

Fast Rotary Drill For Pipeline Blasting

A new, fast, self-propelled pipeline rotary drill unit, for use in continuous blasting on pipeline projects, is announced.



The pipeline Blastholer requires only one operator, has centrally-located controls, features lateral mast movement to permit blast holes to be drilled on 40-in. centers without moving the rig, has mobility for all types of terrain, and is said to cut approximately 80 percent of rock and soil formations. Heavy duty, all-welded structural steel frame is mounted on track; and all moving parts, except track and mast, run in bath of oil. The Blastholer drills holes from 2¼-in. to 3⅞-in., with variable rotary speeds from 25 to 325 rpm and constant controlled down pressure. *Drilling Accessory and Manufacturing Company.*

Circle number (89) on reply card.

Versatile Shovels

Two new additions to the Lima line of power shovels, cranes, draglines, and pullshovels have been announced. The Type 64 has a rated capacity of 40 tons when equipped as a crane. When equipped as a shovel, it has a 22-ft boom, 17-ft dipper handle, and 1¼ cu yd dipper. Changeover from shovel to crane, dragline, or pullshovel is easily made in the field. The Type 64-SC is designed for special crane service and has a rated capacity of 50 tons. *Baldwin-Lima-Hamilton Corp.*

Circle number (90) on reply card.

Repeater Station In One Cabinet

A "one-cabinet" repeater station for cross-over frequency operation in all 2-way radio bands has been introduced. The incorporation of both the communications channel and the relay channel circuitry as well as all interlinks in a single cabinet is designed to cut space and cabinet requirements in half for repeater stations. The new repeater station is designed to operate in both directions with any combination of 2 of the 3 frequency bands assigned to landmobile communications by the FCC. *Allen B. Du Mont Laboratories, Inc.*

Circle number (91) on reply card.

NEW PIPELINE LITERATURE

'One-Shot' Switch for High-Speed Electronics

A data sheet introduces a new series of pushbutton switch assemblies that incorporate an electronic circuit to produce a single, microsecond-length pulse with each operation. This series of "one-shot" switches is said to eliminate the need of designing special pulse input circuits for high-speed electronic switching devices. The switches are designed for use in electronic test circuits, keyboard input consoles, fusing arming and firing circuits, and reflected pulse systems. Photo, dimension drawing, circuit schematic, oscillographs of pulse curves and further technical data are included in the publication. *Micro Switch.*

Circle number (92) on reply card.

Lighting Fixture Solves Special Problems

The reissue of a 20-page technical bulletin on the "V-51" series convertible, vaportight lighting fixtures has been announced. The "V-51" is designed especially for use with heavy-wall, rigid conduit in areas where vapor and heavy-air create lighting problems. Complete description and dimensional data on all parts and accessories plus cut-away views of the exclusive construction of the "V-51" are contained in the bulletin. *Appleton Electric Company.*

Circle number (93) on reply card.

Automatic Data System For Engine Testing

An automatic data handling and recording system for engine test facilities is described in a new bulletin. The system described will measure and process up to 500 test variables, at sampling and readout rates to 100 per second. System specifications are presented. The design is said to be sufficiently flexible to be modified to fit particular engine test program requirements. *B J Electronics, Borg-Warner Corporation.*

Circle number (94) on reply card.

Pipelining from Mojave Desert to British Columbia

"On 3 Pipeline Jobs With Cat Equipment" shows how pipeliners apply their Cat-built machines to handle jobs from the Mojave Desert, through Louisiana bayous, to British Columbia. *Caterpillar Tractor Company.*

Circle number (95) on reply card.

Wheel Tractors in Six Power Sizes

A new 16-page catalog describes a complete line of new wheel tractors in 6 power sizes ranging from 12 to 72.5 hp. The catalog gives emphasis to the new 6-cylinder engines used on the larger tractors and new larger and more powerful internal hydraulic systems. *International Harvester Company.*

Circle number (96) on reply card.

40-Ton Crawler Can Be Stripped Down Fast

Catalog 2773 details the new 40-ton crawler machine that can be stripped down to an 8-ft overall width and approximately 32,000 lb within 2 hours. Other features described include power hydraulic controls, two-speed travel in either direction with hydraulic power steering, independent rapid boomhoist with boom lowering clutch and retractable high gantry that also removes the counterweight under power. *Link-Belt Speeder Corporation.*

Circle number (97) on reply card.

Compressor Controls

"En-Tronic Pipeline Control" describes equipment for automatically starting, loading, capacity control, regulating and shutting down pipeline compressors. The equipment described also applies to other types of power machinery such as gas, diesel and gas-diesel engines, as well as motor-driven reciprocating and centrifugal compressors. *The Cooper-Bessemer Corporation.*

Circle number (98) on reply card.

Backhoe-Loader

An 8-page, 3-color bulletin describes and illustrates the 42-hp Utility 310B wheel-mounted backhoe-loader. The booklet presents 35 operating advantages of the "matched" trenching-loading machine, plus pertinent mechanical details of the Case-built backhoe, loader, and heavy-duty tractor. Action views of the rig working under various conditions are included. *J. I. Case Company.*

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30"	10'x24"x5/8"	154#	84#	144,000#
24"	8'x20"x5/8"	106#	70#	120,000#
18"	6' 3"x16"x5/8"	71#	56#	96,000#
12"	4' 6"x12"x5/8"	39#	42#	72,000#

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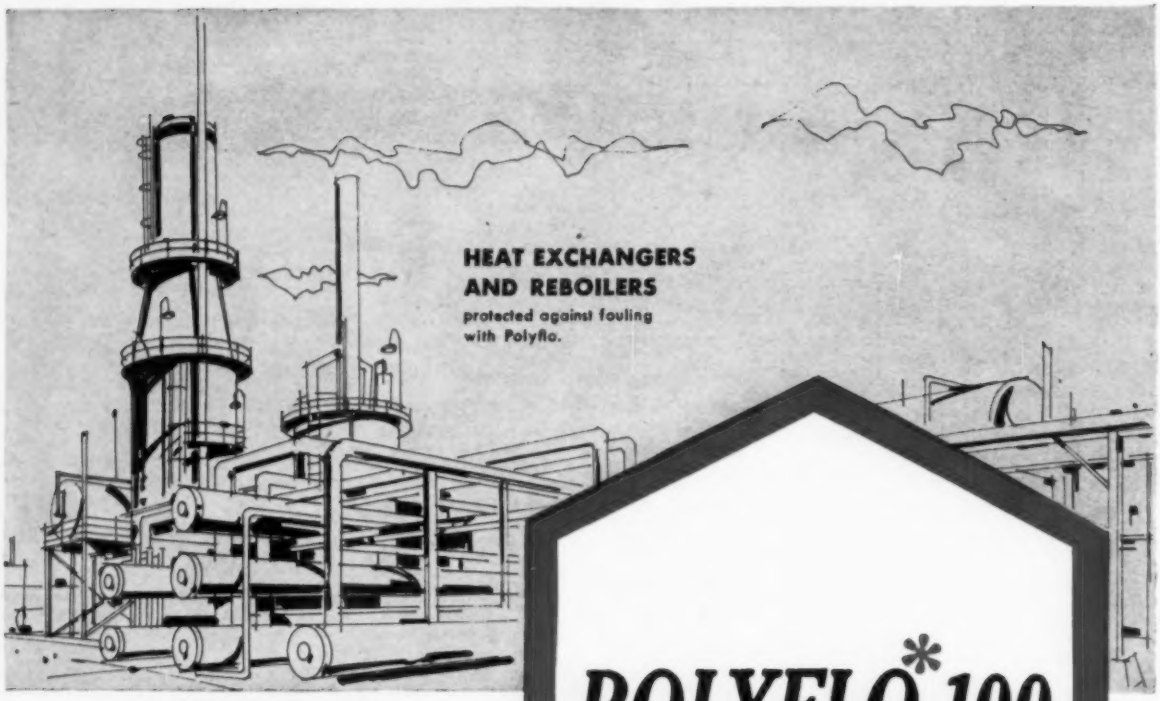

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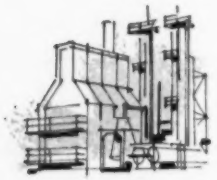

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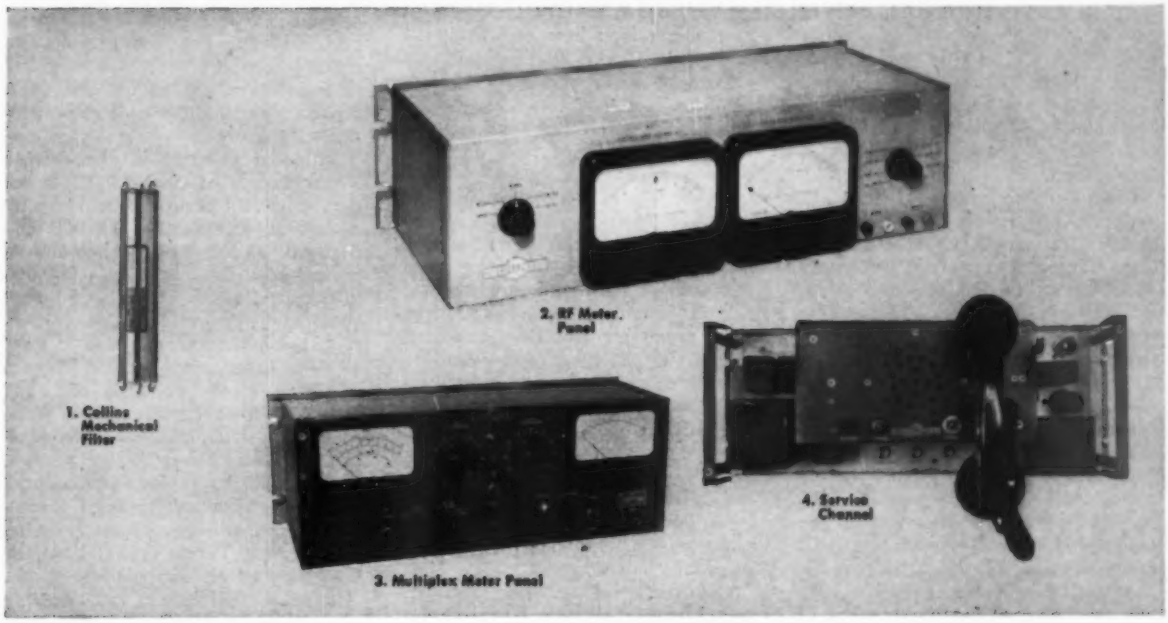

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Pipeline Projects

Texas Gas Announces $40,000,000 Expansion Program

Texas Gas Transmission Corporation has filed an application with the Federal Power Commission requesting authorization for a major expansion program estimated to cost $40,000,000, according to an announcement by W. M. Elmer, president. In the application the company seeks authority to gather and transport through its pipeline system up to 100,000,000 cu ft of natural gas daily for the account of Hope Natural Gas Company, a subsidiary of the Consolidated Natural Gas System, and requests approval to build about 246 miles of pipeline and add 15,760 hp to the existing Texas Gas system.

"The addition of the Consolidated Natural Gas System as a customer through its subsidiary, Hope Natural Gas Company, represents, in my opinion, one of the most important market developments to Texas Gas since the main line system was constructed 10 years ago," Elmer said.

The proposal calls for delivery to be made to Texas Gas in the producing fields, and Texas Gas will gather and transport the gas from the South Louisiana area and deliver it for the account of Hope Natural Gas Company at an interconnection of the facilities of Texas Gas and Texas Eastern Transmission Corporation near Lebanon, Ohio. From that point the gas will be delivered for the account of Hope Natural Gas Company at the existing delivery points between Texas Eastern and the affiliated companies of the Consolidated Natural Gas System.

The expansion requested by this filing is in addition to a $20,000,000 expansion authorized by the FPC on October 24, 1958, which was designed to meet the requirements of the company's existing customers through the 1959-60 winter season.

To serve Hope Natural Gas Company, Texas Gas plans to construct and operate approximately 165 miles of 30-in. diam loop lines and about 81 miles of 26-in. loop lines in Louisiana, Arkansas, Mississippi, Tennessee, Kentucky, Indiana, and Ohio. Included in the 26-in. main line construction is one underwater crossing of the Green River in Kentucky.

Compressor station construction will consist of one new 1760-hp compressor station near Lafayette, Louisiana, and the addition of an aggregate of 14,000 hp to existing compressor stations at Columbia, Louisiana; Covington, Tennessee; Kenton, Tennessee; Calvert City, Slaughters, and Hardinsburg, in Kentucky, for a total of 15,760 additional hp.

Gathering facilities will consist of 93 miles of supply lines, ranging in size from 2⅜-in. to 12¾-in. pipe, all to be in Louisiana and adjacent offshore areas. Twelve meter stations, one check meter station, and various appurtenances are planned.

Construction of the facilities will require about six months after the date authorization is received, and the service proposed for Hope Natural Gas Company is scheduled to begin on November 1.

Revised Applications Filed For Canadian Gas Export

Formal applications have been filed with the Alberta Oil and Gas Conservation Board for permission to export a total of 625,000,000 cu ft per day of natural gas through a combined big-inch pipeline system from the Crowsnest Pass area of Alberta to the border between British Columbia and Idaho in the vicinity of Kingsgate and Eastport. The applications have been made by Westcoast Transmission Company, Ltd., and Alberta and Southern Gas Company Ltd., pursuant to the September report of the conservation board on gas reserves and the concurrent assurance of the Alberta Government that export permits would be granted subject to certain preliminary changes in the original plans.

The conservation board found as a fact that the quantities asked for originally were somewhat beyond the capacity of the committed gas fields to supply. It suggested that the companies scale down their requirements to come within the calculated producibility of the fields that were then under contract. Instead, the companies have both signed up enough additional gas, both from previously committed and new fields, to take care of practically all their original demands. Of the combined total, Westcoast is asking for 165,000,000 cu ft and A & S 460,000,000 cu ft per day.

Included in the new reserves under contract to Alberta and Southern is a portion of the huge Berland River reserve in northwestern Alberta, discovered by British American and Shell Oil. Berland River will be the starting point, under the revised plan, of an extension to the Alberta Gas Trunk provincial gathering system, which will parallel the Rocky Mountain continental divide to the Crowsnest Pass in southwestern Alberta and pick up other large proved reserves along its route. Since Alberta Trunk has a provincial monopoly of all gas gathering within the province, all gas for the combined project will be handled by this line, which will deliver it at the British Columbia boundary to the new proposed 36-in. line leading to the export markets. The two projects are entirely separate, both in supply and in destination, except for this short pipeline, which is designed as an economy measure.

Proposed capacity of the Alberta Trunk line is 650,000,000 cu ft per day, ample for peak load deliveries, at a cost of between $65,000,000 and $70,000,000 for the main line and an overall cost of at least $100,000,000 after providing for laterals. It will consist, tentatively, of 256 miles of 36-in. main line at the southerly end, 75 miles of 30-in. in the central sector, 55 miles of 26-in. at the northerly end, 199 miles of supply laterals and 42 miles of delivery laterals of various diameters.

Westcoast has its gas under contract to Pacific Northwest Pipeline Corporation, while Alberta and Southern has contracted to Pacific Gas and Electric Company. Both applications to the Alberta authorities are only preliminary stages, as they have to go before the federal authorities afterward, and their American customers have to file with the Federal Power Commission. Pacific Gas and Electric already has announced its FPC filing, through a subsidiary. It is not expected that there is any chance of approval in time for start of construction in 1959.

FPC Approves Transco's Budget Type Application

The Federal Power Commission has approved a "budget-type" application by Transcontinental Gas Pipe Line Corporation for the construction and operation during the next 12 months of pipeline facilities, costing up to a total of $4,000,000, which will enable the company to receive additional natural gas into its system.

Transco plans to build lateral and field facilities necessary to enable it to take natural gas that it may purchase from producers in the general area of its existing system. The cost of any single project covered by the authorization, the company said, would not exceed $500,000.

Columbia Gulf Plans A Short Gas Pipeline

An application by Columbia Gulf Transmission Company, seeking authority for the construction and operation of natural gas pipeline facilities at an estimated cost of about $820,000, has been accepted for filing, the Federal Power Commission announces.

Columbia Gulf proposes to construct 11 miles of 12-in. lateral supply line and appurtenant facilities to extend southwesterly from its existing pipeline to a point in the Block 17 field, East Cameron area, Cameron Parish, Louisiana.

Columbia Gulf, a newly-organized subsidiary of The Columbia Gas System, was authorized recently by the commission to acquire and operate the facilities of Gulf Interstate Gas Company.

140-Mile Iranian Gas Line Will Supply Fertilizer Plant

The Iranian government has signed a contract for construction of the country's first nitrogen fertilizer plant at Shiraz and a 140-mile pipeline to supply it with natural gas, the raw material. Cost of the two projects is estimated at $30,000,000.

Montecatini, Italy's largest chemical company, has been appointed general advisor to the Iranian government for the project. A Montecatini process will be used in the manufacture of the anhydrous ammonia produced. Initial plans call for a productive capacity of 100 metric tons per day.

The vast petroleum fields located at Gashsaran and owned by the French-British consortium, ENSA, will supply the natural gas. Procurement of equipment and construction of the plant and pipeline will be entrusted to ENSA.

A portion of the natural gas piped from the petroleum fields will be diverted to Shiraz for domestic and commercial use.

Line Slated to Connect Soviet Fields, Poland

Plans are underway to construct a vast pipeline from Soviet oil fields to Poland, East Germany, Czechoslovakia, and Hungary, according to the official Polish news agency Pap.

The agency also said plans have been drawn up to unify the power systems of Poland, Czechoslovakia, and East Germany. Both plans are part of a mutual economic assistance plan under discussion in Moscow.

Temporary Authority Granted For $35,000,000 Project

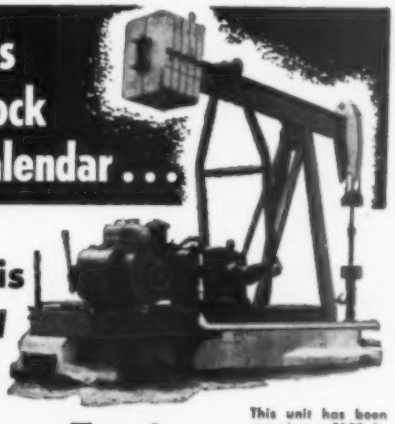
The Federal Power Commission has granted Texas Eastern Transmission Corporation and its subsidiary, Texas Eastern Penn-Jersey Transmission Corporation, temporary authority to construct and operate natural gas pipeline facilities at an estimated cost of $35,138,000.

Texas Eastern proposes to construct 28.8 miles of 30-in. pipeline loops; to add 125,270 hp in new and existing compressor stations, and to build five new meter stations. Penn-Jersey proposes to construct 12.5 miles of 30-in. loops and to add 57,600 hp in new and existing compressor stations.

FPC, in November 1957, temporarily authorized Texas Eastern to construct, but not operate, 59 miles of 30-in. pipeline loops at an estimated cost of $5,890,000. Latest temporary certificate also authorizes the operation of these facilities.

Texas Eastern said the additional facilities would enable it to increase its maximum daily delivery capacity by 101,660,000 cu ft and annual deliveries by 36,902,772,000 cu ft.

Pumping Oil Wells Around the Clock and Around the Calendar . . .



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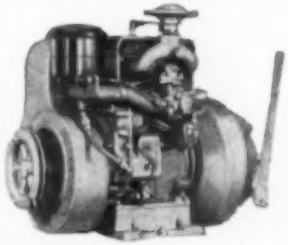
One of the outstanding features of this specially designed engine is its built-in HIGH MOMENTUM FACTOR. This is accomplished through the use of *multiple flywheels.* In addition to the standard cooling flywheel at the cranking end of the engine, an extra-heavy (80 lb.) flywheel is mounted on the take-off end of the crankshaft. This practically *triples* the Momentum Factor (WR^2).

Additionally, an oversize heavy-duty industrial dry type clutch is furnished as standard equipment. This assures long clutch life (to match the engine) under the terrific shock of constantly fluctuating loads that are encountered in oil well pumping.

This is only half of the story. For full details, about the Model THPD Wisconsin Engine, contact the Harley Sales Company's nearest office.



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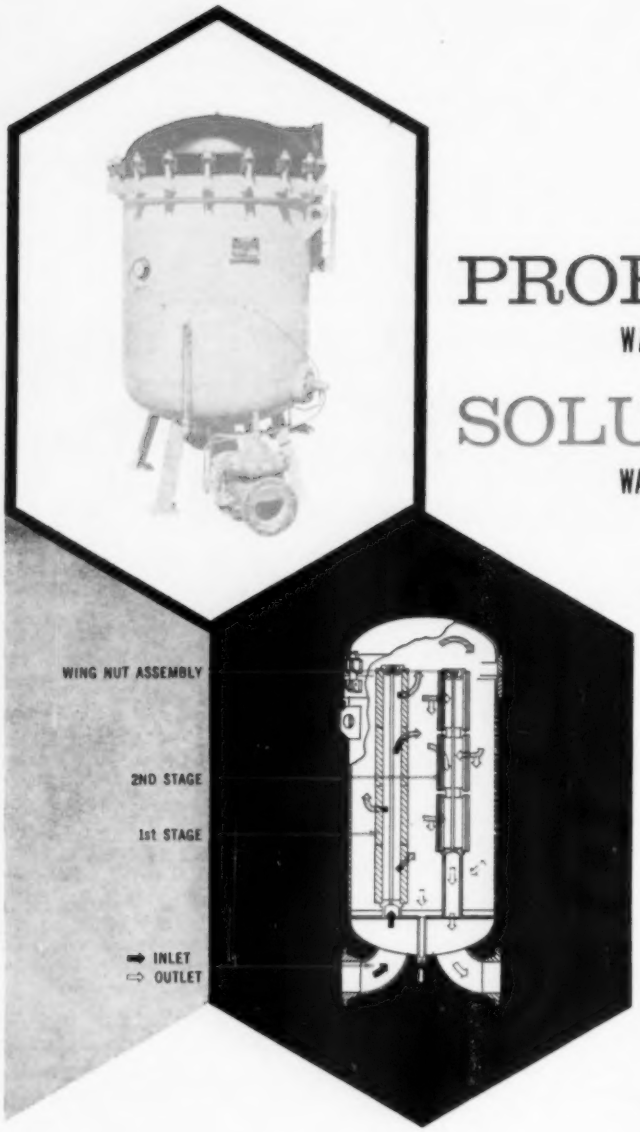

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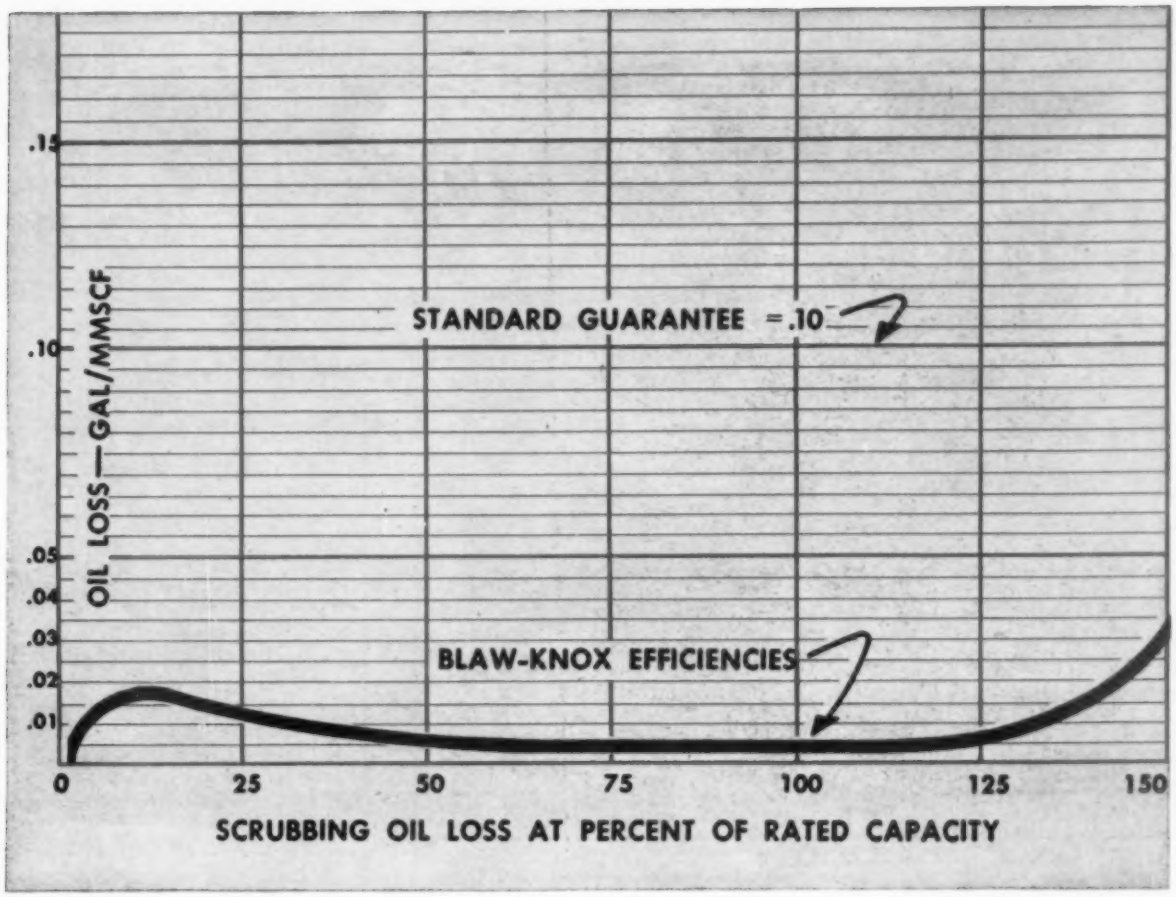

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Laboratory and field tests prove that the new Blaw-Knox Gas Cleaner has the best efficiencies at the widest range of gas flow. Three hundred individual tests plus six weeks of actual on-the-line field operation have been tabulated. The remarkable results are shown graphically in this illustration.

Through the entire range of the new Blaw-Knox Gas Cleaner the scrubbing oil loss at rated capacities is less than .02 gallons per million standard cubic feet of gas.

Accurate efficiencies of gas cleaners should be known before the decision to buy is made. Judge gas cleaners not only on how completely foreign particles are removed (Blaw-Knox can do this down to less than one micron), but also on how oil-free the downstream gas actually is.

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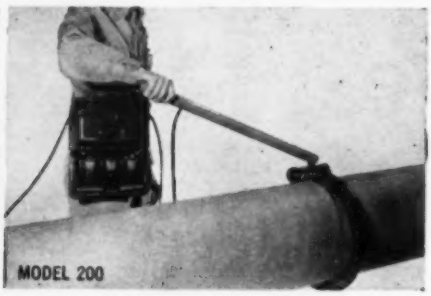

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Projects

Two Submarine Lines Will Be Laid in Persian Gulf

Construction contracts for two submarine pipeline installations in the Persian Gulf have been awarded International Marine Constructors, C. A. and Collins Submarine Pipelines Overseas, Ltd., according to S. V. Collins, president of both firms.

Specialized personnel and equipment will be furnished by Collins Construction Company of Port Lavaca, Texas.

INMARCO will install a 26-mile, 30-in. concrete coated pipeline from Ganaweh, in Iran, to Kharg Island, some 25 miles out in the Persian Gulf for Iranian Oil Exploration and Producing Company.

Preliminary work on this project has begun, including the shipment of several million dollars worth of equipment.

Across the Gulf, dual 32-in. submarine pipelines are to be constructed by Collins Submarine Pipelines Overseas, Ltd., for Basrah Petroleum Company.

These two lines will link a tank farm at Fao, Iraq, to an artificial island 24.3 miles out in the Gulf.

The estimated cost of the combined projects will be in excess of $20,000,000. Project manager for both jobs is H. C. Frankmann.

Maloney **PIPE LINE SPHERES IN NATURAL GAS PIPE LINES**

HYDROSTATIC TESTING • WATER, SAND, AND DISTILLATE REMOVAL

EFFICIENT — Wiping action superior to conventional scraper cups. Can be used to head the water column in hydrostatic testing and to purge the line after testing is complete. Eliminates dew point problems. In gas gathering systems the Sphere will flush sand out of lines along with distillate and water. Sphere will follow flow through sharp bends, tees, etc., without hanging up.

ECONOMICAL — The Maloney Pipe Line Sphere can be used, with full effectiveness, until literally worn out. The life of the Sphere is several times that of a set of scraper cups, and labor in handling is reduced to a minimum. Due to the consistent rate of travel in the line, pigging time can be cut as much as one-half and requires a smaller crew to conduct the pigging operation.

SAFE — The Pipe Line Spheres require substantially lower pressure differential to drive, even through severely obstructed lines. The sphere will ride over many obstructions that would stop a conventional pig avoiding excessive line pressures to dislodge.

Sizes 2 through 24 inch available. Larger sizes are being designed.

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Buckeye Pipeline to Extend Service to Central Michigan

The Buckeye Pipe Line Company will construct an 8-in. refined products pipeline from Wayne (near Detroit) to Flint, Michigan, a distance of some 70 miles. A line into the refining area of Detroit also will be built, which along with another connecting line will afford refiners in the Detroit area a common carrier products pipeline into Central Michigan.

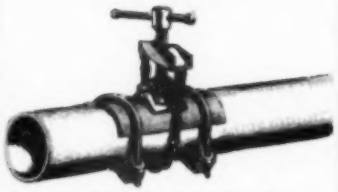
This new addition to Buckeye's Midwest Products System will make available to shippers low cost transportation for their products to the cities of Flint, Owosso, Bay City, and Saginaw, the company states. Also, through the conversion of one of Buckeye's crude lines running south from Wayne, Detroit refiners will obtain pipeline transportation into the Ohio markets.

Saskatchewan Power Plans Big Construction Year

Saskatchewan Power Corporation is planning another big year of natural gas pipeline construction, with an estimated 500 miles or more, but of smaller diameter pipe than was involved in much of its 1958 program of over 500 miles. The principal item so far confirmed for 1959 is an extension of the main line system to take in the city of Yorkton in the northeastern sector, with about 12,000 population. Intermediate points on the way from Regina also will be served.

The cost of this item, including the city distribution system and the lateral, is estimated at close to $3,000,000. The total program will probably run to $12,000,000, a little less than the 1958 construction.

STOP
Pipe Line
LEAKS



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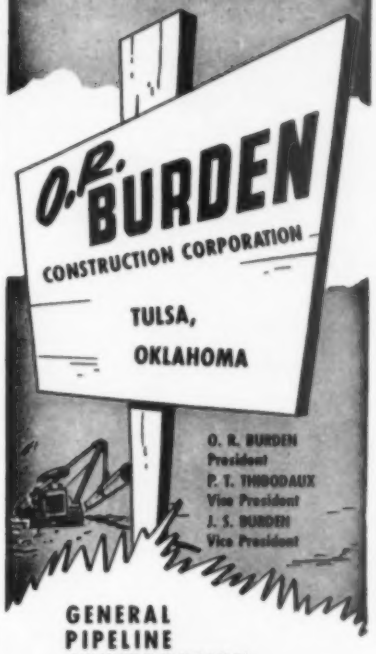

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CONSTRUCTION
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Quoted from Mr. Dillard Stokes' Column, Shreveport Journal, Oct. 13, 1958.
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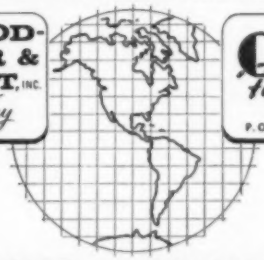

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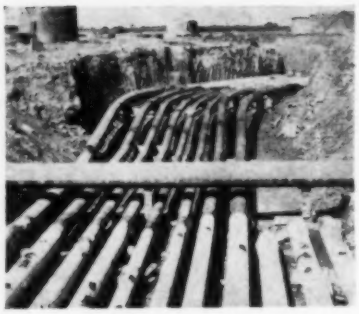

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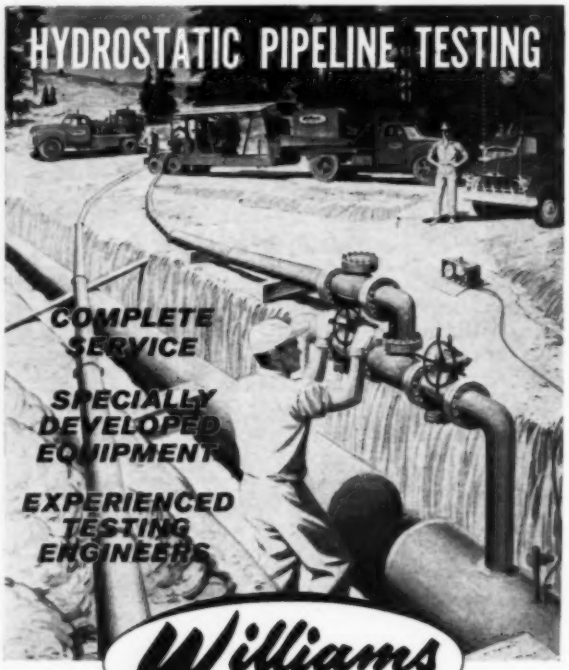

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CANADIAN NEWS NOTES

Pipeline From Weyburn Field, Canada, Is Studied

Engineering studies have been made and the question of feasibility is being investigated, for a possible medium gravity crude oil pipeline from the Weyburn oil field of southeastern Saskatchewan to Regina and Moose Jaw. The proponent is Trans-Prairie Pipelines, Ltd., of Edmonton, which operates the Weyburn field gathering system. Weyburn medium crude is now heavily prorated because of deficient markets.

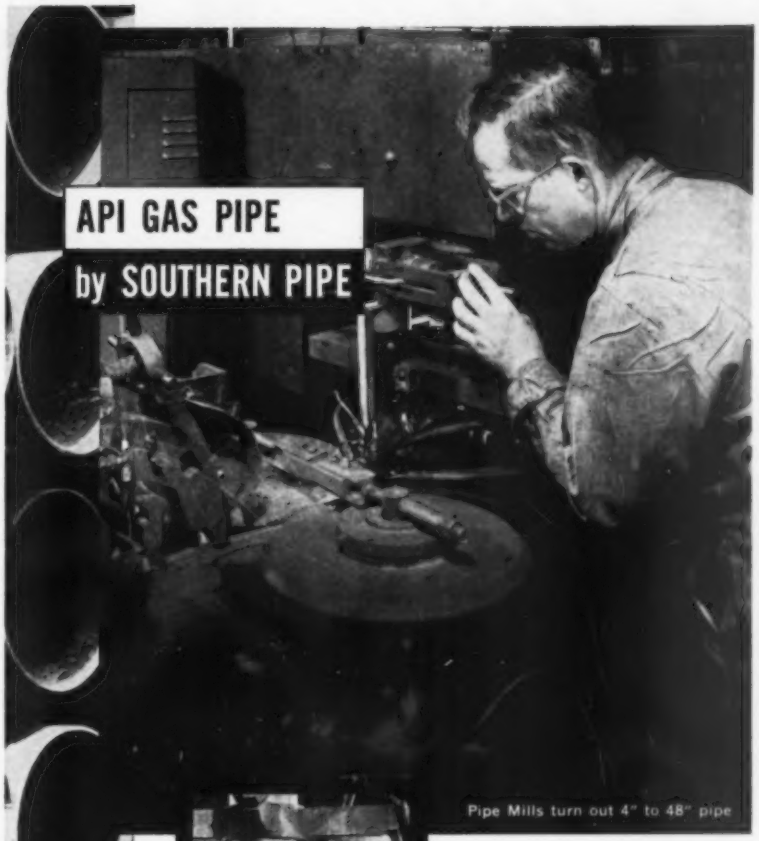
The minimum economic operation would be 12,000 bbl per day through a line that would cost $5,000,000. Total volume of medium crude now being taken by four of the five refineries in the two cities is 6603 bbl per day. The combined capacity of the five plants is 57,500 bbl per day, but 1958 average runs were only 44,500 bbl per day.

The principal economic obstacle to the proposal is the fact that the movement would represent a backhaul against the normal direction of flow through Saskatchewan. At present medium crude from the southwestern fields comes into Regina and Moose Jaw through the south Saskatchewan pipeline. The medium crude that does find a market from Weyburn and Midale, in the southeast, goes to Minnesota and Ontario, through the Westspur, Interprovincial, and Minnesota pipelines.

The other main problem is the price at which crude would have to be laid down at refineries. To increase the limited present runs of high sulfur sour crude would require addition of desulfurization equipment in the refineries. This cost would have to be amortized in a reduced cost of crude compared to the present cost of light gravity crude. The Weyburn crude has considerable differences in refining characteristics from the present southwestern supply, which comes from fields in the Fosterton and Dollard areas.

Automatic Booster Station Now in Full Operation

South Saskatchewan Pipe Line Company has put its new fully automatic booster pumping station in operation. Located at Secretan, approximately the half-way point between the main station in the Cantuar field and the terminal at Regina, the new station will raise capacity to 42,000 bbl per day from its present 33,000 bbl per day. Station pumps will be started and stopped automatically by pressure in the main line.



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HIGH-FREQUENCY
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Southern Pipe was the **first producer** of API approved gas pipe, and API quality thin-wall gas pipe, fabricated by means of Thermotool HIGH-FREQUENCY welding. And, **only** Southern Pipe can give you the better welds that are produced under HIGH-FREQUENCY welding.

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Write for Stanford Research Institutes' Report on HIGH-FREQUENCY welding

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Here's how the Houston Texas Gas and Oil Corporation decided on Polyken Tape for its 1,616-mile natural gas pipeline between Baton Rouge and Miami.

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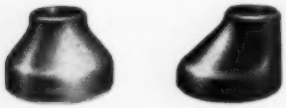

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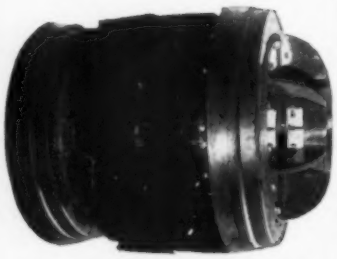

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These and similar operations at pipeline pumping stations are discussed in a new Oakite Service Report, B6878. For a free copy of this helpful report, write to Oakite Products, Inc., 51A Rector Street, New York 6, N.Y.

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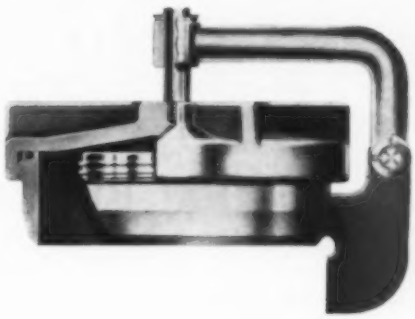

2-Piece Blank Caps are supplied in sizes from 2" through 38", in ASA series 150, 300, 400, 600 and 900. Dependable O-Ring seal for vacuum or pressure service. For complete information, write for Catalog No. 57.

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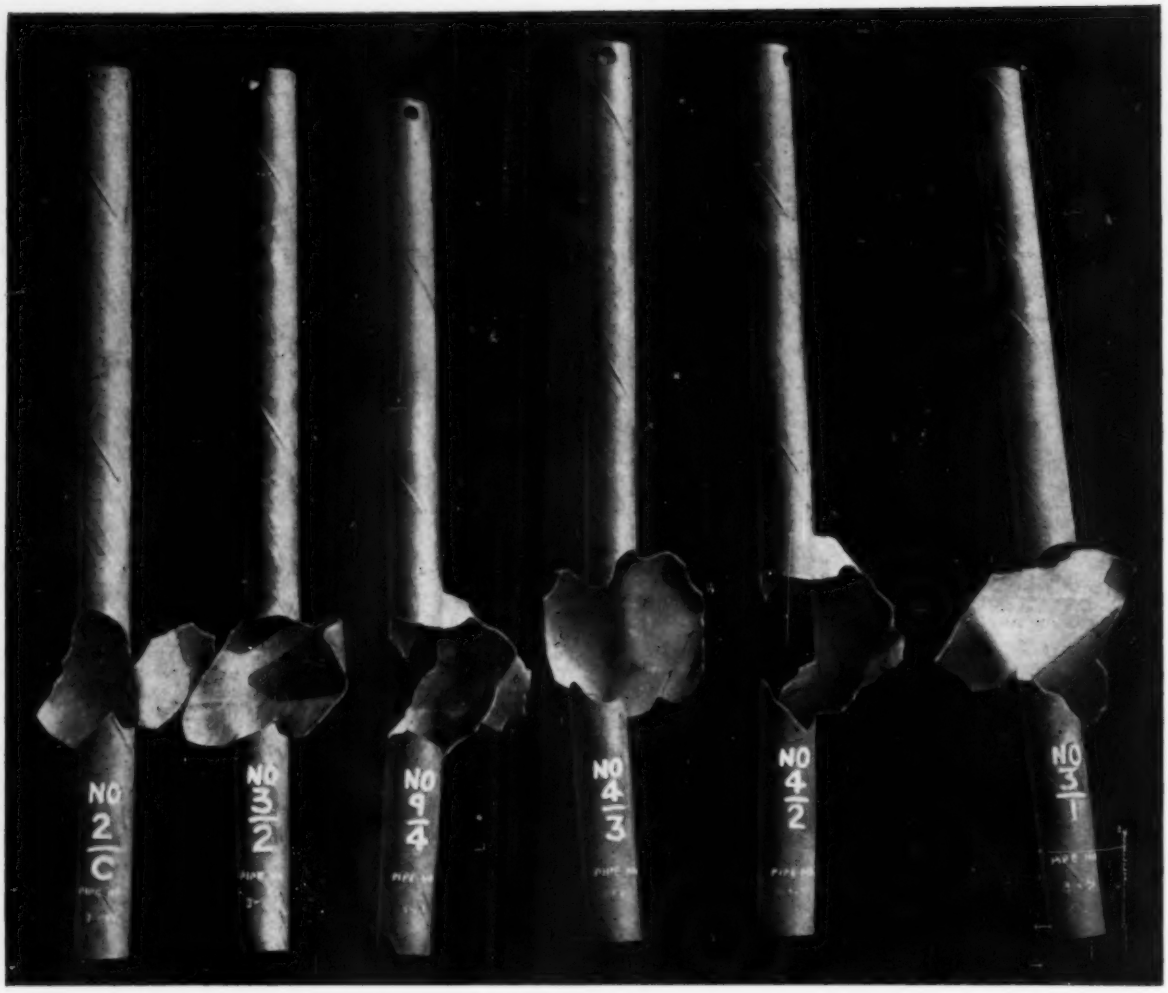

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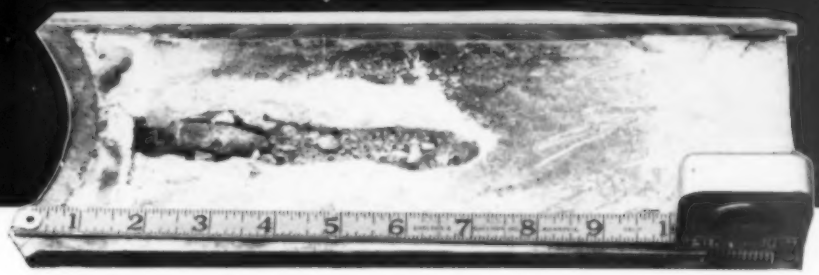
True Ogive Projectile



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